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Draft Environmental Impact Statement

Green-Horse Habitat Restoration and Maintenance Project

National Recreation Area Management Unit, Shasta-Trinity National Forest
Shasta County, California

Green-Horse Habitat Restoration and Maintenance Project
Draft Environmental Impact Statement

Shasta-Trinity National Forest, Shasta County, CA

Portions of Township (T) 33 North (N), Range 3 West (W); T34N R1W, 2W, 3W and 4W; T35N R1W, 2W and 3W, Mount Diablo Base and Meridian

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Abstract: We are proposing to treat vegetation on approximately 41,836 acres on the Shasta Lake Ranger District, Shasta-Trinity National Forest (the Forest), in the Green and Horse Mountain areas above Shasta Lake. Direction and guidance in the Forest Plan (USDA Forest Service 1995a), Forest Fire Management Plan USDA Forest Service 2013), various watershed analyses and the Management Guide for the Shasta and Trinity Units of the Whiskeytown-Shasta-Trinity National Recreation Area (USDA Forest Service 2014) were reviewed to develop the proposed action. Treatment methods include prescribed fire (broadcast or underburning and pile burning), hand thinning and/or brush cutting, pruning and hand piling.

This Draft Environmental Impact Statement (EIS) describes and analyzes three alternatives and issues identified during scoping.

- Alternative 1 (no action) proposes no vegetation treatment in the project area. Ongoing actions from previous decisions would continue to occur in the project area, including hazardous fuels treatment on federal and non-federal lands and fire suppression activities.

- Alternative 2 (proposed action – revised) proposes to treat approximately 41,836 acres of vegetation and includes a site-specific, non-significant Forest Plan amendment. The amendment would change the dead and down material values in the project area within the Management Prescriptions for Limited Roaded Motorized Recreation and Roaded Motorized Recreation from an average of 20 tons per acre and 10 tons per acre, respectively, to an average of 5-15 tons per acre. In addition, approximately 4.61 miles (or 4 acres) of dozer fireline construction or reconstruction are proposed in order to facilitate prescribed fire activities. This is the Preferred Alternative.
- Alternative 3 (no Forest Plan amendment) proposes to treat approximately 13,275 acres of vegetation. Under this alternative, no treatments would occur in Management Prescriptions for Limited Motorized Recreation or Roaded Motorized Recreation. No dozer fireline construction would occur under this alternative.

Reviewers should provide their comments during the review period of the Draft EIS. This will enable us to analyze and respond to comments at one time and to use the information provided in the preparation of the Final EIS. Reviewers have an obligation to structure their participation in the National Environmental Policy Act (NEPA) process so that it is meaningful and alerts the agency to the reviewers' position and contentions (Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 553 [1978]). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement (City of Angoon v. Hodel [9th Circuit, l986] and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334, 1338 [E.D. Wis. 1980]). Comments on the Draft EIS should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

The opportunity to comment ends 45 days following publication of the notice of availability (NOA) in the Federal Register. Written comments may be sent to Jason Fallon at the Shasta Lake Ranger Station, 14225 Holiday Road, Redding, CA 96003; hand delivered written comments may be submitted to the Shasta Lake Ranger Station at 14225 Holiday Road, Redding, CA 96003; and faxes may be sent to (530) 275-1512. Our office business hours for those providing hand-delivered comments are 8:00 am to 4:30 pm Monday through Friday, excluding holidays. Electronic comments must be submitted in a format such as an email message, plain text (.txt), rich text format (.rtf), Portable Document Format (.pdf), or Microsoft Word (.docx) to comments-pacificsouthwest-shasta-trinity-shasta-lake@fs.fed.us. Please ensure it is clear that your comments are for the Green-Horse Habitat Restoration and Maintenance Project.

Summary

Introduction

The Forest Service has prepared this Draft Environmental Impact Statement (Draft EIS) to analyze the potential impacts of prescribed fire and other fuels reduction activities in the Green and Horse Mountain areas. This Draft EIS complies with the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 et seq.), the National Forest Management Act of 1976, and all other relevant Federal and State laws and regulations.

Note: *We revised the proposed action slightly in response to comments received during scoping. The revised proposed action is described below and in more detail in Chapters 1 and 2. The original proposed action became an alternative not considered in detail, for reasons disclosed in Chapter 2.*

Project Area

The Green-Horse project area is located about 20 air miles northeast of the community of Redding, California and directly north of the Pit Arm of Shasta Lake (see figure S-1 below). The project area covers approximately 46,356 acres, including 41,836 acres of National Forest System (NFS) lands and 4,520 acres of non-federal lands. Almost two-thirds of the project area is located within the Shasta Unit of the Whiskeytown-Shasta Trinity National Recreation Area (NRA). The entire project area is within the Shasta Lake Ranger District of the Shasta-Trinity National Forest.

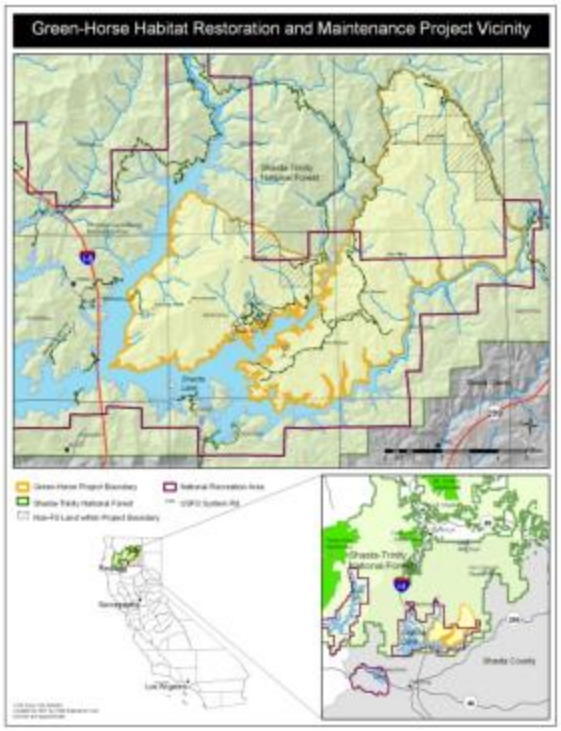

Figure S-1. Green-Horse Project vicinity map

The project area includes seven management prescriptions and four land allocations as described in the Shasta-Trinity National Forest Land and Resource Management Plan (Forest Plan).

Of the seven management prescriptions in the project area (Limited Roaded Motorized Recreation, Roaded Recreation, Wildlife Habitat Management, Late-Successional Reserve, Commercial Wood Products, Riparian Reserve, Special Management Area – RNA), approximately two-thirds of the proposed treatment areas are located within two prescriptions: Limited Roaded Motorized Recreation and Roaded Recreation.[1]

In implementing Forest Plan direction in accordance with the Council of Environmental Quality regulations (40 CFR 1500-1508), this Draft EIS answers the following eight questions:

[1] The Riparian Reserves management prescription occurs within the other management prescriptions.

1 – What action is proposed?

The revised proposed action (Alternative 2) would treat fuels on 41,836 acres of NFS lands through prescribed fire, hand thinning, pruning and piling and hand ignition of piles. The Forest Supervisor of the Shasta-Trinity National Forest will make a final decision as to the method and amount of fuels treatment in the Record of Decision for this project. The proposed action includes approximately 16,168 acres of fuels treatments within inventoried roadless areas (IRAs), 5,378 acres of treatments within the Devil's Rock-Hosselkus Research Natural Area (RNA) and 29,490 acres of treatment in the Shasta Unit of the Whiskeytown-Shasta Trinity National Recreation Area. No commercial timber harvest, road construction or road reconstruction is proposed under any of the action alternatives. Approximately 4.61 miles (4 acres) of dozer line construction/reconstruction are proposed to facilitate implementation of prescribed fire.

The revised proposed action meets the goals and objectives of the Forest Plan for the project area (40 CFR 1502.4(a), 1508.23, 1502.14, and 1502). The other action alternative (Alternative 3) meets the goals and objectives of the Forest Plan for a significantly smaller amount of acreage (i.e. about a third) of the project area. The no action alternative does not meet the goals and objectives of the Forest Plan or the purpose and need for the project.

2 – Why is the project being proposed? (40 CFR 1502.13)

The Green-Horse Habitat Restoration and Maintenance Project is proposed to respond to goals and objectives of the Forest Plan (USDA Forest Service 1995a), as described on page 2 of this Draft EIS, and to meet the need for increased vegetation age class diversity and reduced brush field densities and live-to-dead fuel ratios, as described in Chapter 1 of this EIS.

3 – Alternatives: What other action would meet the same need?

One action alternative (Alternative 3) and a no action alternative to the revised proposed action (Alternative 2) have been analyzed in detail. Alternative 3 provides a different response to key issues while still meeting the stated purpose and need of this EIS. This alternative to the proposed action represents a site-specific proposal developed through an intensive, field-verified, interdisciplinary team evaluation of current conditions in the project area.

Both action alternatives are consistent with the Forest Plan.[2] All applicable Forest Plan Standards and Guidelines have been incorporated into the design of the additional action alternative for all resources. Additional direction comes from applicable laws and Forest Service manuals and handbooks. Each alternative complies with the Northwest Forest Plan (NWFP) (USDA Forest Service and USDI Bureau of Land Management 1994), which was implemented to ensure the maintenance of viable populations of all vertebrate species on the Forest by means of a comprehensive approach based on principles of conservation biology. Forest Plan Standards and Guidelines for Riparian Reserves and the NWFP Aquatic Conservation Strategy were applied to all streams within the project area.

The following is a brief discussion of how the alternatives respond to the key issues identified for the Green-Horse project. A detailed comparison of these issues by project alternative is summarized in Chapter 2, and a full examination of issue comparison by alternative is provided in Chapter 3.

[2] The revised proposed action includes a project-level Forest Plan amendment, which is described in detail in Chapter 2.

Alternative 1 – No Action

Alternative 1 is the no action alternative in the EIS. Under this alternative, no fuel treatment activities would occur in the project area, which would not meet the purpose and need.

Alternative 2 – Proposed Action (Revised)

Alternative 2 (Proposed Action – Revised) addresses Issue 1 – Fire Risk and Fire Hazard and Issue 2 – Dead and Down Material. This alternative would treat all NFS lands within the project area.

Alternative 3 – No Forest Plan Amendment

Alternative 3 (No Forest Plan Amendment) addresses issues that were raised during the scoping period related to the proposed Forest Plan amendment (which would allow for levels of dead and down material below current Forest Plan standards for Management Prescriptions II [Limited Roaded Motorized Recreation] and III [Roaded Motorized Recreation]). This alternative maintains the current Forest Plan standards for dead and down material in those two prescriptions. Because of the constraints of the Forest Plan standards for the two management prescriptions on fuels reduction, this alternative would treat only about one-third of NFS lands within the project area.

4 – What would it mean not to meet the need for project action?

If the need for action is not met, current vegetation conditions in the project area would persist. As vegetation density increases and the diversity of vegetation structure and composition decreases, the quality of wildlife habitat would decline. In addition, fuels in the project area would continue to accumulate untreated, elevating the risk that future fires would be widespread and would be of higher intensity than what occurred historically. Such a fire would imperil documented bald eagle nest sites, other wildlife habitat components and recreational, watershed, visual quality and other resources.

5 – What are the effects of the proposed action, and alternative actions — in comparative format?

Chapter 2 (Alternatives, Including the Proposed Action) introduces how the alternatives meet the purpose and need for the project, and compares outputs, objectives and effects of the alternatives in terms of the key issues. Chapter 3 (Affected Environment and Environmental Consequences) discusses in more detail the effects of the proposed action and alternative actions by issue. Chapter 3 also discusses the affected environment and the proposed and alternative actions' environmental consequences by resource.

The following two issues were determined to be potentially key or significant and within the scope of the project decision. The IDT developed alternatives to the proposed action to address these issues; Chapter 2 of this DEIS describes the alternatives and provides a summary comparison of their effects. See tables 2-7 (Comparison of alternatives by treatment type) and 2-8 (Comparison of alternatives by issue). Chapter 3 examines the existing condition and analyzes the effects or consequences of the project as it relates to these issues. The following summarizes these effects:

Issue 1 – Fire Risk and Fire Hazard

Alternative 1 (No Action) has no direct effects on fire risk and fire hazard in the project area. However, indirect effects related to continued accumulation of untreated fuels and the resulting risk to resources from future high-intensity wildfire would be expected to occur. When combined with the expected continuation of Forest Service fire suppression policies, this alternative could in the long term result in potentially adverse effects to resources (e.g., air quality, soils, water quality, wildlife species and habitat diversity, scenery and recreation values) in the event of a wildfire. This alternative would not re-

introduce fire to the project area in a controlled manner, and future wildfires would become increasingly difficult to control and are likely to burn at higher intensities and/or for longer duration.

Alternative 2 (Proposed Action) would reduce fire risk and fire hazard (as measured by flame length potential and crown fire potential) across the project area. The treatments as proposed would re-introduce fire to the landscape in a controlled manner, maximizing its resource benefits while minimizing adverse impacts through project design features. The treatments would provide protection to current and future bald eagle nest sites and to the recreation residences at Campbell Creek.

Alternative 3 (No Forest Plan Amendment) would reduce fire risk and fire hazard in the areas treated. However, because this alternative would treat only about one-third of the project area – and as no treatment near bald eagle nest sites or recreation residences would occur – the benefits to the project area as a whole would be less than the expected benefits of Alternative 2. The effects of this alternative would be similar to those of Alternative 2 in the areas treated, while the effects of this alternative would be similar to those of Alternative 1 (No Action) in the untreated areas.

Issue 2 – Dead and Down Material[3]

Alternative 1 (No Action) has no direct effects on levels of dead and down materials in the project area. Current dead and down materials would remain untreated and would continue to accumulate unless and until they are consumed by a wildfire or other disturbance.

Alternative 2 (Proposed Action) would maintain dead and down materials at levels appropriate to resource concerns at the landscape level during project implementation through site-specific design features. Amending the Forest Plan as proposed for dead and down materials in the Limited Roaded Motorized and Roaded Recreation management prescriptions would allow meaningful fuels reduction (i.e. a measurable change in flame length and crown fire potential) in these two prescriptions while providing for other resource needs. Over the long term, dead and down materials would be maintained at more historically accurate levels than under current conditions.

Alternative 3 (No Forest Plan Amendment) would have the same effects as Alternative 2 on dead and down materials in the areas treated, since the proposed treatments and project design features in areas common to these two alternatives are the same. The areas proposed for the Forest Plan amendment under Alternative 2 would not be treated, so dead and down material levels in those areas would remain unchanged. Most of the areas encompassing the Limited Roaded Motorized and Roaded Recreation prescriptions currently do not meet Forest Plan standards for dead and down material. Furthermore, it is unlikely that they will meet those standards in the future, as the vegetation types that characterize those two prescriptions in the project area are generally not capable of producing or maintaining dead and down material at Forest Plan standard levels.

While Forest Plan standards may not be met in these areas, the current fuel levels still pose undesirable risks to project area resources with regard to future fire severity. Under this alternative, both dead and down and live fuels in the untreated areas would continue to pose a higher fire risk and fire hazard than in the treated areas.

[3] Dead and down material includes standing snags, large down wood (often referred to as “coarse woody debris”), smaller diameter material and fine organic matter.

6 – What factors will be used when making the decision among alternatives?

The factors that will influence the decision between alternatives include how well the alternatives respond to the identified purpose for the project (summarized below and further discussed on page 5 of the Draft EIS), the expected effects of each alternative on wildlife habitat diversity and quality and future fire behavior in the project area, and other resource benefits and potential adverse effects.

The purpose for the project includes the following:

- Protect, enhance or maintain wildlife habitat quality, including threatened, endangered and Forest Service sensitive species (e.g., bald eagles).
- Trend the area toward historic fire regime conditions.
- Reduce the risks and consequences of public health and safety concerns related to poor air quality during wildfire events.
- Protect, enhance or maintain scenic values, campgrounds, trails and other recreational values in the project area.

7 – Are there any ways to mitigate adverse effects?

Potential adverse impacts may occur from implementing each action alternative. Design features have been incorporated into the action alternatives to reduce these impacts, guided by direction in the Forest Plan. These design features, which are common to both action alternatives, are described in Chapter 2.

We determined through detailed analysis that implementation of either action alternative, with the proposed design features and adaptive management strategy (see Chapter 2), may result in minor to moderate, temporary adverse impacts to some project area resources, with long-term benefits related to reducing the risk of future extreme fire behavior. No mitigation beyond the proposed design features was deemed necessary and none is proposed for these predicted temporary adverse impacts.

8 – What monitoring is necessary?

The Shasta-Trinity National Forest staff annually conducts a review of Best Management Practices (BMP) implementation and effectiveness. The results of this and other monitoring are summarized in a Shasta-Trinity National Forest Annual Monitoring and Evaluation Report. This report provides information about how well the management direction of the Forest is being carried out and measures the accomplishment of anticipated outputs, activities and effects.

Project-specific monitoring, described in Chapter 2, includes assessment of fuel reduction treatments, wet weather closure needs, invasive plants, area closures to prevent illegal vehicle traffic, impacts to the public and permit holders, and populations of two special status botanical species.

Draft EIS Organization

This Draft EIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. All numbers in this document are approximate; small discrepancies may be due to rounding errors and/or different data layers used for analysis. The document is organized into four chapters:

- Chapter 1 explains the purpose and need for the proposed action, discusses how the Green-Horse project relates to the 1995 Shasta-Trinity Land and Resource Management Plan (Forest Plan), and identifies the significant, or key, issues driving the Draft EIS analysis.
- Chapter 2 describes the proposed action and alternatives to the proposed action, including a no action alternative, and compares the alternatives by treatment acres and environmental consequences with regard to the significant issues identified in Chapter 1.
- Chapter 3 describes the natural and human environments potentially affected by the proposed action and alternatives, and discloses what potential effects are anticipated.
- Chapter 4 contains the list of preparers, the project mailing list (the names of individuals, agencies and organizations who received the scoping notice and the Draft EIS) and a glossary.
- Appendices provide additional information on specific aspects of the proposed project, literature cited and an index.

This Draft EIS incorporates documented analyses by summarization and reference where appropriate. Copies of this Draft EIS may be obtained from the NRA Management Unit at the Shasta Lake Ranger Station in Redding, California. Additional documentation, including more detailed analyses of project area resources, may be found in the project record located at the Shasta Lake Ranger Station.

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Chapter 1. Purpose of and Need for Action

The Green-Horse Habitat Restoration and Maintenance Project Environmental Impact Statement (EIS) describes the anticipated effects of, and alternatives to, a proposed habitat restoration and maintenance project on the northeast side of Shasta Lake. This Draft EIS describes the no action alternative (Alternative 1), the proposed action (Alternative 2), and one other action alternative for implementing prescribed fire. The action alternatives do not include any commercial timber harvest or road construction, reconstruction or project-related road maintenance. This Draft EIS discloses environmental effects that are expected from each alternative and proposed design features to reduce the risk of adverse effects to resources of concern.

The 1995 Shasta-Trinity National Forest Land and Resource Management Plan (USDA Forest Service 1995a) (hereafter referred to as the Forest Plan), together with applicable environmental laws and regulations, provides direction for this project. The Green-Horse project proposes to trend the project area from the existing condition to the desired condition as identified in the Forest Plan for land use designations that allow prescribed fire.

The interdisciplinary team (IDT) used a systematic approach for analyzing the proposed action and other alternatives, evaluating the environmental effects and preparing this EIS. The planning process complies with National Environmental Policy Act (NEPA) and Council on Environmental Quality (CEQ) regulations. Planning was coordinated with the appropriate Federal, State and local agencies and local federally-recognized tribes. The public, agencies and tribes were involved in the planning process through letters and personal conversations.

The best available science was considered in preparation of this EIS. However, what constitutes best available science may vary over time and across scientific disciplines. This EIS and the project record identify the analysis methodologies used, reference reliable scientific resources, discuss responsible opposing views, and disclose incomplete or unavailable information, scientific uncertainty and risk (40 CFR 1502.9(b), 1502.22, and 1502.24).

The project record contains the scientific information considered: papers, reports, literature reviews, review citations, academic peer reviews, science consistency reviews, and results of field reviews to validate the best available science. This EIS incorporates by reference (per 40 CR 1502.21) the project record, including specialist reports and other technical documentation. Information from specialist reports has been summarized in Chapter 3. The project record is located at the NRA Management Unit office at Shasta Lake Ranger Station in Redding, California.

Location of the Project Area

The Green-Horse project area, which encompasses 46,356 acres, is located on the northeast side of Shasta Lake, about 20 air miles northeast of Redding, California. The legal map description of these lands is listed in table 1-1 below. The project area includes the Devils Rock Inventoried Roadless Area (IRA), Devils Rock-Hosselkus Research Natural Area (RNA), the Madrone Managed Late Successional Area (MLSA) and portions of the Shasta Unit of the Whiskeytown-Shasta-Trinity National Recreation Area (NRA).

Table 1-1. Legal description of the Green-Horse Project

Township (MDM*)	Range	Sections
T33N	R3W	1-3
T34N	R1W	6, 7
T34N	R2W	1-12, 15-21, 28-31
T34N	R3W	1, 4-10, 12-33
T34N	R4W	1, 11-14, 23-26
T35N	R1W	6, 7
T35N	R2W	3, 4, 8-10, 14, 16, 20-22, 24, 26-36
T35N	R3W	29-33, 36

*MDM = Mount Diablo Meridian

Elevation ranges from 1,065 feet at the high water mark of Shasta Lake to 4,325 feet atop Town Mountain. Most of the project area is within the Administratively Withdrawn and Matrix Forest Plan land allocations.

Forest Plan Goals and Objectives

The purpose and need of the Green-Horse Habitat Restoration and Maintenance Project are derived from Forest Plan direction (see Relationship to the Forest Plan in this chapter). The Forest Plan includes Forest-wide multiple use goals and is hereby incorporated by reference. These goals include, but are not limited to, the following:

- Maintain natural wildlife species diversity by continuing to provide special habitat elements within Forest ecosystems (Forest Plan, page 4-6).
- Take advantage of management opportunities to increase populations of game species including mule deer, black-tailed deer, elk, and turkey in balance with the ecosystem (Forest Plan, page 4-6).
- Manage selected chaparral lands to create a natural mosaic of vegetative conditions and/or age classes (Forest Plan, page 4-16).
- Maintain air quality to meet or exceed applicable standards and regulations (Forest Plan, page 4-4).
- Restore fire to its natural role in the ecosystem when establishing the Desired Future Condition of the landscape (Forest Plan, page 4-4).

Achievement of the above goals and objectives is key to achieving the overall desired future condition (as identified in the Forest Plan) of "healthy forest stands that provide for a diversity of wildlife habitat, good scenic quality, public health and safety, and a reduction of fire hazards and risks (Forest Plan, pages 4-4 through 4-6)."

Background

Since 1998, the Forest Service has completed several watershed assessments to study the condition of National Forest System (NFS) lands in and around the Green-Horse project area.[4] These documents provide detailed information on the existing condition of the physical and

[4] See the McCloud Arm, Squaw Creek and Pit Arm Shasta Lake Watershed Analyses (USDA Forest Service 1998, 1999 and 2010, respectively) in the project record.

biological resources and public uses within the project area. Results of these watershed assessments have included recommendations for maintaining and enhancing wildlife habitat quality. Considering these recommendations and recent concerns about fire risk and its potential consequences to wildlife habitat and other resources in the project area, staff at the NRA Management Unit developed the Green-Horse Habitat Restoration and Maintenance Project (hereafter called the "Green-Horse project" or "the project").

The Green-Horse project area lies within the Pit Arm, Squaw Arm and McCloud Arm drainages of Shasta Lake and is part of the Klamath Mountains Bioregion. Fire is the most widespread and dynamic disturbance affecting the Klamath Mountains Bioregion. Studies of fire scars and fire history in the Klamath Mountains show the historic fire pattern (often called "fire regime") in the project area typically consisted of frequent low- to mixed-severity fires (Taylor and Skinner 1998, Skinner et al. 2006).

Vegetation communities in the project area are considered "fire adapted" – the vegetation communities and natural fire occurrence are interrelated and interdependent. Natural fire disturbance serves a key role in creating and maintaining vegetation community diversity and in consuming fuels accumulations. Frequent low- to moderate-severity fire removes dead fuel accumulations as well as a minor portion of living vegetation while leaving most of the larger overstory vegetation intact.

Frequent low- and moderate-severity fire allows overstory trees to grow more quickly and forest stands to develop more structural diversity. Small openings and areas of reduced overstory shading are created by frequent low- and moderate-severity fire, allowing understory vegetation to develop and thus enhancing wildlife browse. Past management activities, including more than a century of fire suppression, have disrupted the historic fire regime and led to the current vegetation conditions, which are characterized by low structural diversity and overall poor quality of wildlife browse and other habitat components.

Fire suppression has also resulted in high fire hazard (as defined by fuel loading and vegetation densities) and high fire risk (as defined by fire start occurrence). We are, therefore, concerned about the risks to wildlife habitat and other resources from severe fire behavior in the event of a wildfire. Recent fires near or within the project area include the 2012 Bagley Complex, 2008 SHU Lightning Complex fires, the 2004 Bear fire, the 1999 Jones fire and the 1992 Fountain fire, among others. Weather conditions, poor access for firefighting forces, rugged terrain, fuel conditions, and many other factors contributed to large fire growth in most of these recent fires. During one or more of these fires, areas of high fire severity experienced soil erosion, loss of wildlife habitat and degraded visual quality in the Shasta Lake viewshed. In addition, several structures were lost and air quality standards exceeded the California Air Resource Board thresholds.

Existing Condition of the Project Area

The existing vegetation, wildlife habitat quality, fuels and fire risk in the project area are summarized as follows:

- Currently most of the project area consists of dense, relatively homogeneous forested stands of medium- and small-sized trees. Over 90 percent of forested stands have between 60 and 100 percent overstory canopy cover. Understory vegetation is sparse to nonexistent in these dense stands because most of the site resources are being utilized by the overstory and because little sunlight reaches the forest floor. In contrast, less than

two percent of forested stands are open-canopied and have available resources to support an appreciable understory vegetation layer.

- Approximately 75 percent of the project area has a historic fire return interval (the amount of time between natural fire occurrences) of 20 years or less. In contrast to historic conditions, over 90 percent of the project area has not experienced fire for 60 years or more, primarily due to active fire suppression. More than 75 percent of the project area has "missed" three or more natural fires that would have been expected to occur without active fire suppression. This longer fire return interval has resulted in the accumulation of abnormally dense surface and ladder fuels, increasing the likelihood of high-severity fires that consume large areas of forest. The continued accumulation of unburned fuels increases the risk that future fires will be more difficult to suppress, and will have extreme fire behavior and rapid, uncontrolled growth similar to that of recent wildfires adjacent to the project area.
- Fire exclusion has resulted in reduced palatability of browse for wildlife. Forage and browse species composition and condition influence the distribution of herbivorous wildlife species and the species for which they are prey. While a future large-scale high-severity fire may increase the availability of browse habitat, it would also likely reduce the occurrence of effective cover for wildlife.
- Current accumulation of heavy fuels in the form of brush or young pine regeneration and the subsequent risk of high-severity fire threaten the existing large overstory trees that provide critical nesting structure for bald eagles near Shasta Lake. Without these large trees, the habitat surrounding the lake would no longer be suitable for eagle nesting.
- Future high-severity fire may affect the availability of late-successional habitat for wildlife species. In addition, species associated with late-successional habitat may be displaced in the event of a large-scale disturbance such as high-severity fire.
- The high fire risk and high fire hazard pose threats to other physical, biological, and social values in the project area (e.g., soil stability, hydrology and air quality, threatened, endangered, and Forest Service Sensitive plant, terrestrial and aquatic wildlife species, scenic values, and recreation).

Desired Condition for the Project Area

The desired condition for the Green-Horse project area is an ecosystem that more closely approximates historic conditions with regard to vegetation age class diversity, live-to-dead fuel ratios, fire frequency and severity, and resilience of project area resources to future fires.

Need for the Project

Based on comparison of the existing and desired condition as described above, there is a need for the following vegetation conditions in the project area:

- **Increased age class diversity**

  Current age class diversity is low due to a lack of disturbance and to regeneration that has created homogeneous, even-aged stands. A mix of early-, mid- and late-seral age classes, with no one age class representing more than 50 percent of the project area is needed to trend the project area toward the desired condition as described in the Forest Plan.
- **Reduced stand and brushfield densities and live-to-dead fuel ratios**

Current stand and brush field densities and live-to-dead fuel ratios exceed historical norms. Up to a 30 percent reduction in vegetation density - particularly in younger, smaller-diameter individuals - is needed. The project fuels specialist determined that a decrease in the live–to-dead fuel ratio by as much as 50 percent is needed to trend the project area toward the desired condition as described in the Forest Plan.

Purpose of the Project

The Green-Horse project is proposed to respond to the above-described need, as well as to goals and objectives identified for the project area in the Forest Plan, for the following purpose:

- **Protect, enhance or maintain wildlife habitat quality, including threatened, endangered and Forest Service sensitive species (e.g., bald eagles).**

  Due to current vegetation and fuels conditions, wildlife habitat quality is at risk of degradation from future wildfires. High fuel concentrations surrounding known bald eagle nest sites, if ignited by high-intensity fire, could imperil those sites. In addition, there is an opportunity to increase the diversity of vegetation composition and structure, thereby improving habitat for game and non-game species.

- **Trend the area toward historic fire regime conditions.**

  As noted above, the current fire regime in the project area has departed from what occurred historically. Whereas fire return intervals historically averaged from 3 to 40 years, the longer intervals described above have resulted in uncharacteristic accumulations of downed fuels and live ladder fuels. Under these fuel conditions, future wildfires are likely to burn at increased intensities, with increased severity of effects to resources.

- **Reduce the risks and consequences of public health and safety concerns related to poor air quality during wildfire events.**

  During recent wildfires air quality was severely degraded, often for long periods, and nearby communities suffered the health effects of poor air quality. Under the current fuel conditions, similar poor air quality conditions are likely to occur during future wildfires.

- **Protect, enhance or maintain scenic values, campgrounds, trails and other recreational values in the project area.**

  The current fuels conditions elevate the risk that future wildfires – which are likely to burn at increasingly high intensities – could cause widespread changes to scenic values and imperil recreational facilities such as campgrounds, trails, trailheads and recreational residences. In addition, the current fuels conditions increase the risk that human-caused ignitions could escape initial attack and become widespread, high-intensity wildfires.

Proposed Action (Revised)

NOTE: Comments received during the scoping period resulted in a minor revision of the proposed action. The revision is noted in italic text below and is described in detail in Chapter 2 (Alternative 2- Proposed Action [Revised]).

The Green-Horse project would establish a trend toward the desired conditions as described in the Forest Plan by reducing fuel accumulations on approximately *41,836 acres*. This would be

accomplished by addressing an underlying purpose and need (40 CFR 1502.13) with the following activities:

- Prescribed broadcast burning or underburning would occur on approximately *41,625*[5] acres.
- Hand thinning and pruning of small trees and brush, followed by hand piling and pile burning or underburning, would occur on approximately 88 acres adjacent to private property.
- *Hand thinning and pruning of small trees and brush, followed by hand piling and pile burning, would occur on approximately 35 acres surrounding recreation residences at Campbell Creek.*
- Hand thinning and pruning of small trees and brush, followed by hand piling and pile burning or underburning, would occur on approximately 83 acres surrounding bald eagle nest sites.
- Approximately 4.61 miles (4 acres) of dozer line would be constructed or reconstructed in order to assist fire managers in safely conducting prescribed fire.

Fuels treatments would occur over a period of 7 to 10 years, and an adaptive management strategy would allow managers to adjust treatments over time if they discover new information or changed conditions. The proposed action does not include any commercial timber harvest, new forest system or temporary road construction, existing road reconstruction or project-related road maintenance.

In order to proceed with this project, we are also proposing a project-level Forest Plan amendment that would allow us to reduce dead and down material requirements in specific areas where current Forest Plan direction conflicts with both the desired fuel levels and the capacity of those areas to meet Forest Plan standards. This has been proposed to better achieve fire behavior and fuel reduction objectives while providing for wildlife habitat needs and soils protection and productivity. See the section titled “Alternative 2” in Chapter 2, where we explain the proposed action and Forest Plan amendment in depth.

See Figure 2-1 in Chapter 2 for a map depicting the revised proposed action.

Scope of the Analysis

The Green-Horse Habitat Restoration and Maintenance Project EIS is a project-level analysis. The scope of the analysis is confined to addressing the potential environmental consequences and issues related to project implementation.

In accordance with NEPA, the agency has the responsibility to assess direct and indirect environmental effects resulting from an agency action as well as the cumulative effects of all past, current and reasonably foreseeable actions. This EIS analyzes those actions that fall within the different cumulative effects analysis areas described for each pertinent resource and that have the potential to affect the resource.

[5] The amount of prescribed broadcast burning or underburning originally proposed was 41,637 acres. This amount – which was the result of a mapping error – has been corrected to 41,625 acres.

Decisions to be Made

The Forest Supervisor will decide whether to implement an action alternative or no action. If an action alternative is selected, he will decide on the design and location of the proposed activities, as well as the schedule for implementation.

Relationship to the Forest Plan

The Green-Horse Habitat Restoration and Maintenance Project EIS tiers to the Shasta-Trinity National Forest Land and Resource Management Plan (Forest Plan) EIS (USDA Forest Service 1995a) as directed by the Code of Federal Regulations (40 CFR 1502.20). All page references in this document refer to the version of the Forest Plan available at the following Shasta-Trinity National Forest webpage:

http://www.fs.usda.gov/main/stnf/landmanagement/planning

Public Involvement

Public involvement is a key component of the planning process. Among other things, the scoping process is used to invite public participation, to help identify public issues, and to obtain public comment at various stages of the environmental analysis process. Although scoping begins early, it is a process that continues until a decision is made.

Public Scoping

This project first appeared on the Shasta-Trinity National Forest's schedule of proposed actions on July1, 2009 and has continued to be listed ever since. The project has also been listed on the Forest website. On May 25, 2011, we mailed a "scoping document" describing the proposed action and seeking public comments to 78 individuals, Tribes, organizations, businesses and agencies. Our notice of intent (NOI) to prepare an environmental impact statement was published in the Federal Register on May 27, 2011. We requested comments be received by June 30, 2011. We received 8 comments during this "scoping period". Using the comments we received, the project interdisciplinary team developed a list of issues to address. See Appendix D (Public Involvement) for a detailed description of the public involvement process, the issues identified during the scoping period, and a list of commenters.

Availability of the Draft EIS

The Notice of Availability for this Draft EIS is published in the Federal Register and in the Redding Record Searchlight (the official newspaper of record). The Draft EIS has been mailed to everyone on the project mailing list who requested a paper copy. A list of recipients is included in Chapter 4 of the Draft EIS. The Draft EIS will also be available at the Shasta Lake Ranger Station and upon request. This Draft EIS is also available electronically at the following address:

http://www.fs.fed.us/nepa/project_content.php?project=29469

Issues

Issues serve to highlight concerns over effects or unintended consequences that may occur from the proposed action. Issues often describe unwanted potential effects that can be reduced or eliminated by modifying the proposed action or developing project design features to address specific concerns. Issues not resolved in this way may be addressed in the environmental

analysis by developing issue-specific effects indicators, or by developing alternatives to the proposed action. Unresolved issues can only be addressed by development of an additional action alternative. All new alternatives must meet the project's purpose and need and be consistent with existing law, regulation and policy.

Not all comments received were identified as issues. Comments that are not addressed as issues described above are generally:

- suggestions for actions or analysis beyond the scope of the stated purpose and need;
- not directly related to the proposed action;
- general comments of support or information;
- already incorporated in the analysis plan;
- already decided by higher law, regulation or policy; or
- conjectural in nature and not supported by scientific evidence.

Issue 1: Fire Risk and Fire Hazard

One unresolved issue was raised during scoping by residents of the Campbell Creek recreation tracts. Citing concern for future fire behavior, the commenters requested additional fuels treatment surrounding their recreation residences at Campbell Creek.

The interdisciplinary team developed Issue 1 in response to this concern. Consideration of this issue led the interdisciplinary team to slightly modify the proposed action; the minor revision is described on page 6 above and in Chapter 2.

Unit(s) of measure: The comparison of alternatives for this issue focuses on the following units of measure:

- Changes in flame length potential across the project area (effectiveness of the proposed activities in influencing this component of future fire behavior on a landscape level), expressed in acres by category from very low to very high.
- Changes in crown fire potential across the project area (effectiveness of the proposed activities in influencing this component of future fire behavior on a landscape level), expressed in acres by category for surface fire, passive crown fire and active crown fire.

Issue 2: Dead and Down Material

Several commenters expressed concern that implementation of the proposed Forest Plan amendment to deviate from Forest Plan standards for dead and down material in two Forest Plan management prescriptions would adversely affect resources dependent on this important ecosystem component. Most of the comments focused on the impacts on snag retention and coarse woody debris which, along with fine organic matter and smaller diameter materials, comprise the dead and down material for which the Forest Plan amendment was proposed.

The interdisciplinary team developed Issue 2 in response to this concern. Consideration of this issue led the interdisciplinary team to develop Alternative 3, which is described in detail in Chapter 2.

Unit(s) of measure: The comparison of alternatives for this issue focuses on the following unit of measure:

- Changes in down material levels (fine organic matter, smaller diameter materials and coarse woody debris) based on predicted percent reduction in current down material levels and compliance with Forest Plan standards (Appendix G of the Forest Plan) for the wildlife species addressed in this document.
- Changes in the number of standing snags from current levels, based on predicted amount of active crown fire during project implementation.

Additional Environmental Considerations

Comments received pertaining to the following considerations did not result in development of additional action alternatives, nor do they meet the criteria of issue. Resource considerations are addressed through analysis, best management practices and design features. The following environmental resources are protected by Forest Plan standards and guidelines and by laws and other constraints; the effects of the proposed activities on each are not significant. Detailed discussion of these resources can be found in the specialists' resource reports and in Chapter 3.

Other resource concerns addressed in this analysis include the following:

- Air quality
- Vegetation
- Special Status Plants and Fungi
- Noxious Weeds
- Terrestrial and Amphibian Wildlife
- Hydrology
- Soils
- Geology
- Aquatic Wildlife
- Recreation, Scenery and Special Uses
- Cultural resources

Applicable Laws, Executive Orders, Policy and other Guidance

National Forest management is guided by various laws, regulations, and policies that provide the framework for all levels of planning. Guidance is provided in Land and Resource Management Plans (Forest Plans) and site-specific planning documents such as this environmental impact statement. These higher-level documents are incorporated by reference and can be obtained from Forest Service offices.

Laws and Executive Orders

Federal laws and executive orders pertaining to project-specific planning and environmental analysis on NFS lands in the Green-Horse Project area include, but are not limited to, the following:

Federal Laws

- The National Environmental Policy Act (NEPA) of 1969, as amended
- The Clean Water Act of 1977, as amended

- The Clean Air Act of 1963, as amended in 1970 and subsequent years
- The National Forests Management Act (NFMA) of 1976, as amended
- The Forest and Rangeland Renewable Resource Act (RPA) of 1974, as amended
- The Archaeological Resources Protection Act of 1979
- The National Historic Preservation Act of 1966
- The Multiple Use Sustained-Yield Act of 1960
- The Endangered Species Act (ESA) of 1973
- The American Indian Religious Freedom Act of 1980

Executive Orders

- Executive Order 11593 (protection and enhancement of the cultural environment)
- Executive Order 11988 (floodplains)
- Executive Order 11990 (wetlands)
- Executive Order 12898 (environmental justice)
- Executive Order 12962 (aquatic systems and recreational fisheries)
- Executive Order 13186 (Migratory Bird Treaty Act)

Policy

Forest Service Manual and Handbook Policy and Direction

Management activities are also guided by policy and direction in Forest Service Manuals (FSMs). Examples of FSM direction related to the proposed action include, but are not limited to, the following:

- FSM 2300, Chapter 2380 – Landscape Management
- FSM 2600 – Wildlife, Fish and Sensitive Plant Habitat Management
- FSM 4000, Chapter 4063 – Research Natural Areas
- FSM 5100, Chapter 5140 – Fire Use

Hazard Tree Policy

While Forest Plan standards and guidelines (Forest Plan, Standard and Guideline 20b(2)) emphasize the management of "hazard" or "danger" trees along roads and in developed areas, they also apply to other forest management activities and follow Occupational Safety and Health Administration (OSHA) regulations (US Department of Labor 1994).

Other Guidance

National Fire Plan

The National Fire Plan also provides management direction for this project. The National Fire Plan (NFP) was developed in August of 2000, following a landmark wildland fire season, with the intent of actively responding to severe wildland fires and their impacts to communities while ensuring sufficient firefighting capacity for the future. The proposed fuels treatments were designed in part to meet the NFP's goals for hazardous fuels reduction. For more information please visit the National Fire Plan website at:

http://www.forestsandrangelands.gov/resources/overview/

Aquatic Conservation Strategy

The Aquatic Conservation Strategy (ACS) is incorporated into the forest plan from the Northwest Forest Plan Record of Decision (USDA Forest Service and USDI Bureau of Land Management 1994, as amended). The ACS was developed to "maintain and restore the ecological health of watersheds and aquatic ecosystems contained within them on public lands" and to "prevent further degradation and restore habitat over broad landscapes as opposed to individual projects or small watersheds" (USDA Forest Service and USDI Bureau of Land Management 1994). The nine ACS objectives are as follows:

- Maintain and restore the distribution, diversity, and complexity of watershed- and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.
- Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic- and riparian-dependent species.
- Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.
- Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction and migration of individuals composing aquatic and riparian communities.
- Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage and transport.
- Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.
- Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.
- Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.
- Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.

Shasta-Trinity National Forest Fire Management Plan

Forest Plan standards and guidelines for land allocations and management prescriptions applicable to the project area are discussed above (see Relationship to the Forest Plan). Additional direction for management of both unplanned ignitions and prescribed fire is provided in the 2013 Shasta-Trinity National Forest Fire Management Plan (USDA Forest Service 2013, pages 5 and 23-41).

Watershed Analysis

We considered recommendations made in several watershed analyses encompassing the project area in developing the proposed action. These include the following:

- McCloud Arm Watershed Analysis (USDA Forest Service 1998)
- Squaw Creek Watershed Analysis (USDA Forest Service 1999)
- Pit Arm Shasta Lake Watershed Analysis (USDA Forest Service 2010)

Chapter 2. Alternatives, Including the Proposed Action

Introduction

This chapter describes and compares the alternatives considered for the Green-Horse project. It presents the alternatives in comparative form, highlighting the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public.

Alternatives Considered in Detail

Alternative 1 – No Action

Alternative 1 is the no action alternative. If this alternative is selected, no fuels treatments would occur and there would be no need to amend the Forest Plan. Current management and uses of the National Forest System lands in the project area would continue. This alternative represents the existing conditions of the project area and the progression of these conditions that would occur naturally over time if we do not implement an action alternative. This alternative provides a baseline of conditions for us to compare with potential effects of the action alternatives.

Alternative 2 – Proposed Action (Revised)

Alternative 2 is the Preferred Alternative. This alternative includes 41,836 acres of fuels treatments that we would accomplish over 7 to 10 years using an adaptive management strategy. It would require amending the Forest Plan to change down wood requirements in order to achieve our fuel reduction objectives and protect soils in specific management prescription areas. As stated previously, there would be no commercial timber harvest and no new road construction, reconstruction or project-related road maintenance. The overall goal is to create a landscape that would provide fire managers more options in the future to allow fire to play its natural role in the ecosystem. Figure 2-1 below displays a map of this alternative.

Treatment acres and percentage of treatment area by Forest Plan land allocation under Alternative 2 are displayed in table 2-1 below. Treatment acres by Forest Plan management prescription and treatment type under this alternative are summarized in table 2-2 below.

Table 2-1. Alternative 2 treatment acres and treatment percentage by Forest Plan land allocation

Administratively Withdrawn Areas	Matrix Lands	Late Successional Reserves	Riparian Reserves
21,979 acres	15,684 acres	4,173 acres	[15,605 acres*]
53%	37%	10%	N/A*

*Riparian reserve acres occur within other prescriptions and are not counted as part of the total acreage.
% = percent

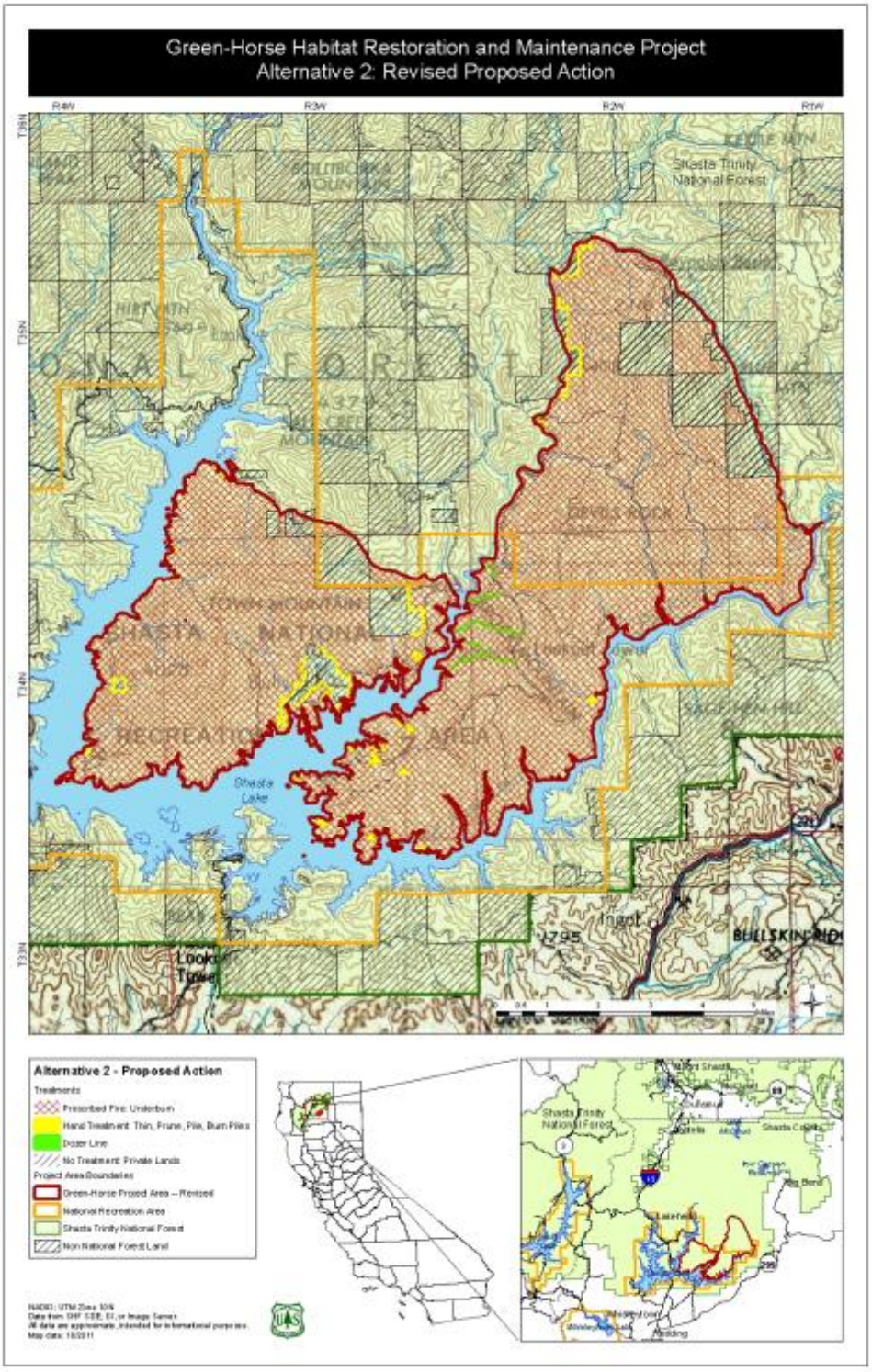

Figure 2-1. Green-Horse Project – Alternative 2 –Proposed Action (Revised)

Table 2-2. Alternative 2 treatment acres by Forest Plan management prescription and treatment type

Forest Plan Management Prescription	Prescribed Fire: broadcast burn or underburn	Hand Treatment: thin / prune / pile / burn piles or underburn	Dozer Lines
Limited Roaded Motorized Recreation (II)	16,563	37	2
Roaded Recreation (III)	9,570	110	2
Wildlife Habitat Management (VI)	5,778	21	0
Late-Successional Reserve (VII)	4,136	37	0
Commercial Wood Products (VIII)	202	< 1	0
Riparian Reserve (IX)	[15,517]*	[88]*	[0]*
Special Management Area – RNA (X)	5,376	2	0
Total	41,625	207	4

*Riparian reserve acres occur within other prescriptions and are not counted as part of the total acreage.

Fuels Treatments

Fuels treatments would consist of prescribed fire underburns and hand thinning and pruning small trees and brush. Debris from thinning and pruning would be hand piled and burned or underburned. We hope to accomplish an average of 5,000 acres of fuels treatments each year. The timing and amount of treatment we could accomplish would depend on predicted weather conditions, fuel moisture and requirements to maintain State and Federal air quality standards.

To protect forest resources from potential impacts, and to ensure we accomplish the fuels treatments safely and in compliance with applicable laws and regulations, we have developed site-specific design features, which include measures such as limited operating periods and use of an approved burn plan (see design features WILD-1a,WILD-2 and FIRE-1 below). We have also developed monitoring measures to determine the effectiveness of the project's design and associated design features (see Monitoring below).

Prescribed Fire Underburns

Prescribed fire underburns are controlled low- to moderate-intensity fires applied to the landscape to reduce the dangerous accumulation of combustible forest fuels. Prescribed underburns would be applied on 41,625 acres in a mosaic pattern, with some portions of the treated areas likely remaining unburned due to low fuel concentrations. The initial application of prescribed fire would be designed to remove live and dead vegetation on the ground as well as lower branches of trees to prevent a wildfire from spreading from the ground into the forest canopy.

An average of 30 to 60 percent of brush and browse cover – much of which is currently overgrown and unpalatable to wildlife – would be burned in up to two separate prescribed fire applications per treatment area to stimulate new growth.

In Riparian Reserves, prescribed fire would be primarily of low intensity, with no more than 10 percent of the area receiving a moderate-intensity burn. Moderate-intensity burns in Riparian Reserves are considered acceptable when implemented with design features to protect soils and other resources (see design features WATER-1 through WATER-8 and RIPN-1 through RIPN-10 below).

Fire crews would construct firelines by hand where natural barriers do not exist; these would provide a starting point for ground-based ignitions and holding crews. In addition, about 4.61 miles (approximately 4 acres) of 8-foot-wide dozer firelines would be constructed or improved in order to facilitate the implementation of prescribed fire.

Crews would ignite prescribed fires on the ground with handheld torches or from the air using helicopters. Prescribed fire may be conducted any time of year as long as a site-specific burn plan (design feature FIRE-1) addresses this option, and fire managers take into account limited operation periods (LOPs) and other project design features. Desired flame lengths in the treatment areas would vary from 0 to 8 feet within the threat zone of the wildland-urban interface and as resource objectives require in other areas.

Hand Thinning, Pruning, Brush Cutting, Piling and Burning Treatments

Near Private Property Boundaries – Treatments using hand thinning, pruning, brush cutting, hand piling and pile burning would be applied in these areas that are within the defense zone of the wildland-urban interface. These treatments would occur within approximately 50 feet of private property boundaries and are intended to reduce flame lengths to 4 feet or less during project implementation in order to keep prescribed fire off private lands. Small conifer trees up to 8.0 inches in diameter would be thinned, to an average spacing of approximately 15 feet. Hardwood species up to 4 inches in diameter would also be thinned, retaining a minimum canopy cover of 75 percent where it already exists. Brush cover would be reduced to encourage surface fire rather than crown fire behavior during burning. These treatments would be conducted on approximately 88 acres of National Forest System lands next to private property boundaries.

Around Identified Bald Eagle Nest Sites – To protect current and future bald eagle nest sites from a severe wildfire, we would use hand thinning, brush cutting, pruning, piling, and burning of hand piles on 83 acres to reduce fuels that could contribute to a crown fire. Desired flame lengths in these treatment areas range from 0 to 4 feet. Treatments would extend approximately 300 feet around the perimeter of identified nest sites and would not be conducted during the season when bald eagles are nesting unless otherwise approved (design feature WILD-2).

Around recreation Residences at Campbell Creek – To provide protection to recreation residences at Campbell Creek, hand thinning, pruning, brush cutting, piling and pile burning would occur on approximately 35 acres of NFS lands surrounding the Campbell Creek recreation residences. Desired flame lengths in these areas range from 0 to 4 feet.

Wildland–Urban Interface – The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuel. See figure C-1 in Appendix C.

Defense Zone – The area within one-quarter mile of a structure or group of structures.

Threat Zone – The area beyond the one-quarter-mile defense zone to a distance of 1.5 miles from a structure or group of structures or other improvements.

Adaptive Management Strategy

The treatment methods described above represent the maximum amount of fuels reduction activities we would accomplish in the project area during the life of the project. As the project progresses, we may discover we need to adjust treatments based on new information or changed conditions. For example, we might schedule secondary treatment in an area if we determine that the initial treatment did not achieve the desired objective, or we might cancel or modify

prescribed fire within an area if a wildfire or other unanticipated natural disturbance occurs. The adaptive management strategy would also allow us to modify a prescribed underburn around newly-discovered bald eagle nest sites to the hand thinning, pruning, piling and pile burning treatments designed to protect known bald eagle nest sites.

In this situation, we would compare the potential effects of the changes with those predicted in this analysis and determine whether the effects would be the same or less than what we originally planned. As required by Forest Service policy, these changes and analysis would be documented and approved by the responsible official. If it appears that potential effects of the changes would be greater than what was originally analyzed, the changes would either not be implemented, or a new environmental analysis would be completed.

Forest Plan Amendment

To accomplish the fuels treatments in Alternative 2, a project-specific Forest Plan amendment would be needed. We propose to amend the Forest Plan to allow retention of an average of 5 to 15 tons of down wood per acre in the areas designated as Management Prescription II (16,602 acres) or III (9,682 acres). This amendment would only be applicable to the Green-Horse project for the duration of the treatments.

Currently, the Forest Plan requires an average of 20 tons per acre of unburned dead/down material[6] for Management Prescription II (Limited Roaded Motorized) (Forest Plan, p. 4-47). Management direction for Management Prescription III (Roaded Recreation) is to provide an average of 10 tons of unburned dead/down material per acre on slopes less than 40 percent and where feasible, the same amount on slopes over 40 percent (Forest Plan, page 4-65 to 4-66).

Soil scientists agree that soil cover should be maintained at levels that sustain soil productivity and that do not elevate wildfire risk and severity – and the resulting detrimental effects to soils. In dry environments, biological decay is limited, which allows accumulation of dead and downed material. Fire plays an important role in recycling nutrients in the debris. However, increased fire intensity quickly reduces available nitrogen in soil (Bormann et al. 2008).

Localized site conditions present two issues with the current standards for dead and down material in these management prescription areas. In the majority of these administrative areas the standards are currently not met and are highly unlikely to be met even without fuels treatments. Treating dead and down material to reduce fire risk and fire hazard would further trend these areas away from the Forest Plan standards. In these areas – as well as in areas where the Forest Plan standards are met – current fuel levels still pose a risk of detrimental effects to soils in the event of a wildfire.

The portions of the project area encompassed by these two management prescriptions are characterized by a wide range of vegetation types that historically supported a range of down wood levels. Several fire and fuels specialists recommend a spectrum of down wood levels based on vegetation type and fire regime (Harmon 2002, Brown et al. 2003). Other researchers describe the difference between current and historical down wood conditions prior to fire suppression and active land management (Wright et al. 2002, Stephens et al. 2007), and the influence of down wood levels on recent fire behavior (Knapp et al. 2005, Saab et al. 2006, Uzoh

[6] Dead/down material includes standing snags and fine organic matter and large woody material (often referred to as “coarse woody debris”).

and Skinner 2009). See the project Fire and Fuels Report in the project record for a detailed discussion of the findings of these peer-reviewed publications.

The desired fuel loading may vary across the project area according to factors such as current fuel levels, vegetation type, wildlife habitat needs (e.g., protection of bald eagle nest sites and provisions for fisher, marten, and northern spotted owls), soil standards, or wildland-urban interface prescriptions. Amending the Forest Plan would better enable us to achieve the stated fuel reduction objectives while providing for wildlife habitat needs and protecting soil and soil productivity.

Alternative 3 – No Forest Plan Amendment

This alternative was developed in response to comments requesting that we follow Forest Plan standards for dead and downed wood throughout the project area – in essence, that we not implement the Forest Plan amendment proposed in Alternative 2.

A preliminary analysis indicated that, of the 26,284 acres within Management Prescriptions II and III (for which the amendment was proposed), only about 4,712 acres currently meet Forest Plan standards for dead and downed wood. Of those acres, only about 6 acres would meet Forest Plan standards following treatment. As a consequence, the IDT dropped all of the lands in those two management prescriptions from proposed fuels treatment under Alternative 3. In addition, portions of other management prescriptions were dropped because they were scattered and isolated from the remainder of the project area and/or too small to warrant treatment.

No dozer line would be constructed under this alternative, and no fuels treatment would occur around known bald eagle nest sites or the Campbell Creek recreation residences. A total of approximately 13, 275 acres would be treated under this alternative. Figure 2-2 below displays a map of proposed activities under Alternative 3.

Treatment acres and percentage of treatment area by Forest Plan land allocation under Alternative 3 are displayed in table 2-3 below. Treatment acres by Forest Plan management prescription and treatment type are summarized in table 2-4 below.

Table 2-3. Alternative 3 treatment acres and treatment percentage by Forest Plan land allocation

Administratively Withdrawn Areas	Matrix Lands	Late Successional Reserves	Riparian Reserves
5,377	5,829	2,069	[4,955]
40%	44%	16%	N/A*

*Riparian reserve acres occur within other prescriptions and are not counted as part of the total acreage.
% = percent

Table 2-4. Alternative 3 treatment acres by Forest Plan management prescription and treatment type

Forest Plan Management Prescription	Prescribed Fire: broadcast burn or underburn	Hand Treatment: thin / prune / pile / burn piles or underburn	Dozer Lines
Limited Roaded Motorized Recreation (II)	0	0	0
Roaded Recreation (III)	0	0	0
Wildlife Habitat Management (VI)	5,608	21	0

Forest Plan Management Prescription	Prescribed Fire: broadcast burn or underburn	Hand Treatment: thin / prune / pile / burn piles or underburn	Dozer Lines
Late-Successional Reserve (VII)	2,064	5	0
Commercial Wood Products (VIII)	200	< 1	0
Riparian Reserve (IX)	[4,944]*	[11]*	[0]*
Special Management Area – RNA (X)	5,376	2	0
Total	13,247	28	0

*Riparian reserve acres occur within other prescriptions and are not counted as part of the total acreage.

< = less than

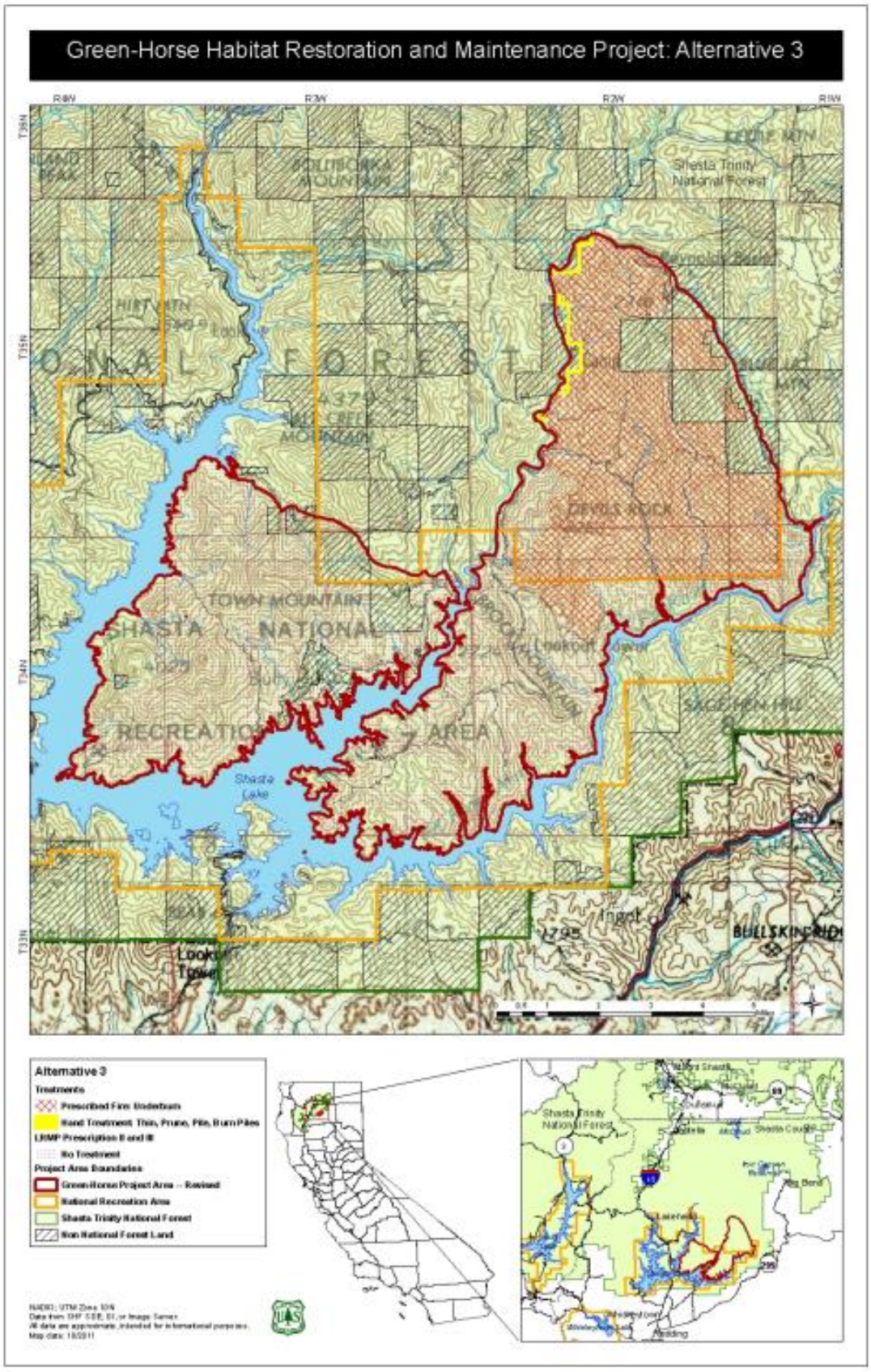

Figure 2-2. Green-Horse Project – Alternative 3 – No Forest Plan Amendment

Design Features Common to Both Action Alternatives

We have incorporated the following design features into both action alternatives to ensure we achieve our objectives, protect forest resources and social values, and provide for public safety. All project design features for Alternative 2 also apply to Alternative 3, with the exception of design features related to dozer line construction (which would not occur under Alternative 3).

General

GEN-1 Personnel and contractors involved with the implementation of this project would participate in environmental training annually to ensure compliance with the design features listed below.

GEN-2 Prior to initiating fuels treatment work near private lands, property boundaries would be flagged as needed to avoid innocent trespass.

Public Health and Safety

SAFE-1 Temporary closures would be implemented, with proper signage and/or guided traffic (e.g., flaggers) for public entry and use as needed to facilitate safe project implementation and, where practical, provide alternative locations for camping, picnicking, and boat launching.

SAFE-2 Design features for air quality (see below) would be implemented to minimize health hazards due to smoke emissions.

SAFE-3 Felling of danger trees[7] during project implementation is expected to be a rare occurrence; danger trees felled would be left on site and either consumed during prescribed fire, hand piled and burned, or retained for coarse woody debris as appropriate.

Air Quality

Project planning and implementation would comply with applicable Federal, State of California, and Shasta County Air Quality Management District (AQMD) air quality laws and regulations concerning overall project emissions. The following prevention and mitigation measures emphasize prescribed burning coordination and mitigating smoke impacts:

AIR-1 A smoke management plan would be developed in accordance with Shasta County AQMD direction and submitted to the AQMD prior to implementation.

AIR-2 Prescribed burning would be avoided during periods of high public use or mitigated through smoke management procedures that would minimize impacts to areas of high public use.

[7] According to Occupational Safety and Health Administration (OSHA) regulations, a danger tree is defined as "A standing tree that presents a hazard to employees due to conditions such as, but not limited to, deterioration or physical damage to the root system, trunk, stem or limbs, and the direction and lean of the tree." OSHA 1910.266(h)(1)(vi) directs that "Each danger tree shall be felled, removed or avoided. Each danger tree, including lodged trees and snags, shall be felled or removed using mechanical or other techniques that minimize employee exposure before work is commenced in the area of the danger tree. If the danger tree is not felled or removed, it shall be marked and no work shall be conducted within two tree lengths of the danger tree unless the employer demonstrates that a shorter distance will not create a hazard for an employee."

Fire and Fuels

FIRE-1 A detailed prescribed fire implementation plan (burn plan) would be completed prior to the use of prescribed fire. The burn plan would include all required elements as set forth in Forest Service Manual (FSM) 5140 and the Interagency Prescribed Fire Planning and Implementation Procedures Guide.

Hydrology, Fisheries, Soils and Geology

Hydrology

WATER-1 Table 2-5 below shows the protocol for determining when heavy equipment may be used based on soil moisture conditions at 4- to 6-inch depths (best management practice [BMP] 5-6). Equipment (i.e., dozers) would not be used on soil conditions described in the unshaded table cells inside the thick black border. Equipment may be used on soil conditions described in the gray shaded table cells.

Table 2-5. Protocol for determining operability of equipment on soils*

Soil Moisture Percent Increases Downward	**Coarse Soils Loamy sands, fine sandy loam, very fine sands, coarse sands**	**Light Soils Fine sandy loams, sandy loams, very fine sandy loam**	**Medium Soils (<35% clay), Sandy clay loam, loam, silt loam, sandy clay loam, clay loam**	**Heavy Soils (>35% clay), Clay loam, sandy clay, silty clay loam, clay**
Dry soils	Dry, loose, single grained, flows through fingers.	Dry, loose, flows through fingers.	Powdery, dry, sometimes slightly crusted but breaks down into powdery conditions.	Hard, baked, cracked sometimes has loose crumbs on surface.
Slightly moist soil	Still appears dry, will not form a ball with pressure.	Still appears to be dry; will not form a ball.	Somewhat crumbly, but will hold together from pressure.	Somewhat pliable; will form ball under pressure. At plastic limit.
Moist soil	Still appears dry, will not form a ball with pressure.	Tends to ball under pressure but seldom will hold together.	Forms a ball and is very pliable, sticks readily if high in clay.	Easily ribbons out between fingers, has a slick feeling. At plastic limit.
Very moist soil	Tends to stick together slightly, sometimes forms a very weak ball.	Forms a weak ball breaks easily, will not stick. Plastic limit or nonplastic.	Forms a ball and is very pliable, sticks readily if high in clay. Exceeds plastic limit.	Easily ribbons out between fingers, has a slick feeling. Exceeds plastic limit.
Wet soils	Upon squeezing, free water may appear. Wet outline is left on hand. Nonplastic.	Upon squeezing free water may appear. Wet outline left on hand.	Can squeeze out free water. Wet outline left on hand.	Puddles and free water forms on surface. Wet outline left on hand.

* Based on soil moisture at 4- to 6-inch depth. Use this protocol by digging a small pit and sample 4 to 6 inches below the mineral soil surface (below the surface litter). Determine soil texture (coarse soils, light soils, medium soils or heavy soils) to know what soil textural group to use. Collect enough soil to form a 1- to 2-inch ball by molding with hand pressure. Pick out excessive rock fragments and squeeze with 6 directional squeezes. If a ball is formed that holds together under repeated tosses (1 to 2 feet into the air) then the soil is too wet for equipment operation.

< = less than; > = greater than

WATER-2 A minimum of 40 to 60 percent soil cover would be retained on soils with high to very high erosion hard rating. A minimum 30 percent cover would be retained on all other soils.

WATER-3 Prescribed fire treatment prescriptions would be designed to avoid adverse effects on soil and water resources. Prescribed fire would be planned to ensure that fire intensity and duration do not result in detrimentally burned soils (BMP 6-2). Whenever feasible, prescribed fire (underburning, broadcast burning, and slash piles) would be planned when soils are wetter and fuels are dry to decrease damage to soils.

WATER-4 Erosion control techniques such as water barring, or debris placement would be used on prescribed firelines, especially on soils with high erosion hazard ratings (BMP 6-3).

WATER-5 Slash material from hardwoods (i.e., manzanita and oak branches) that are thinned within the Shasta Lake riparian reserve would be retained, as needed, for fish habitat improvement structures (i.e., juvenile fish cover) in the lake.

WATER-6 Passage of storm flows would not be obstructed.

WATER-7 Activities may occur during the wet season (October 15 to May 1) under the following conditions: a long-term dry weather forecast and/or the ability to winterize activities (e.g., erosion control measures) at the end of the day. Favorable forecast periods would also be of a suitable length to allow completion or winterization of the task undertaken before precipitation events occur. Prescribed burning may occur outside the period specified above within acceptable burn windows as this action is dependent on fuel moistures, weather conditions and other limitations.

WATER-8 Treatments within known geologically sensitive areas would be field-reviewed and the treatment prescription refined as needed by an earth scientist and fuels officer. A minimum 50-foot equipment exclusion buffer would be flagged above the crown or head of active or potentially active landslides or modified based on geoscientist site-specific evaluation. No cutting of trees or other riparian vegetation would occur along landslides, except for trees that pose a threat to property or human health

WATER-9 Roads that are used to access the project area would be maintained and/or improved. It is highly likely that fuel treatment activities such as pile burning will occur during moist periods, a time when roads are susceptible to damage. Rolling dips must be maintained, culvert must be kept free of debris and sediment that could plug pipes. Road aggregate may be needed to prevent road ponding and rutting. If damage to roadway occurs with project implementation, it will be restored before the next large storm event.

Geology

Geo-1 Known caves within the project area would be field inspected prior to project implementation to identify potential issues, and to develop site specific mitigation measures as appropriate to protect the cave resources.

Geo-2 A thorough stereoscopic review of aerial photos would be conducted by the Forest Geologist prior to project layout to search for additional unmapped marble outcrops.

Geo-3 All marble outcrops identified by the aerial photo inventory that are located within burn units would be field inspected by the Forest Geologist before project implementation to evaluate the severity of prescribed fire likely to occur in that area, and to determine if special mitigation measures would be needed during implementation.

Geo-4 If additional caves are found within burn units during project layout or implementation, or following treatments, they would be field inspected by the Forest Cave Coordinator and Forest Geologist, evaluated for significance and mitigation measures developed as needed.

Geo-5 Cave locations would be held confidential in accordance with the Federal Cave Resource Protection Act of 1988. Such information would be made available to appropriate implementation personnel as needed to protect cave resources from inadvertent damage during implementation.

Riparian Reserves

RIPN-1 Table 2-6 below provides the minimum riparian reserve boundaries by category of stream and waterbody widths within Riparian Reserves (Forest Plan, pp. 4-53, 4-54).

Table 2-6. Riparian reserve boundaries by category of streams and waterbodies

Stream and Waterbody Category	Minimum Extent of Riparian Reserve Width (in feet)
Intermittent or Ephemeral Channels	100 on either side of channel
Fish-bearing Streams	300 on either side of channel
Perennial Non-fish-bearing Streams	150 on either side of channel
Spring	100 from the edges of riparian vegetation.
Constructed Ponds and Reservoirs	150 feet slope distance from full pool for Shasta Lake
Seasonally Wet Meadows greater than one acre	150 from the edge of the meadow

RIPN-2 In most instances, broadcast and underburn prescribed fire would not be ignited within Riparian Reserves, but fire would be allowed to back down into Riparian Reserves. Fire may be ignited within Riparian Reserves only if backing fire alone has not accomplished fuel reduction objectives and after a qualified hydrologist, fisheries biologist, wildlife biologist and soils scientist have determined that direct ignition would benefit Riparian Reserves and would meet Aquatic Conservation Strategy objectives.

RIPN-3 Riparian reserves that encompass inner gorges would extend to cover the entire inner gorge area, plus a 50 foot buffer, if it is greater than 150 feet in width. All equipment is excluded from inner gorges except at designated crossings.

RIPN-4 Riparian reserves that are unmapped would be identified and protected, prior to and/or during implementation, in accordance with appropriate protection measures. Upon field review, if ephemeral streams show no sign of annual scour, they may be treated based on the Forest Plan management prescription for that area.

RIPN-5 All firelines associated with prescribed burns would be placed outside of Riparian Reserves except for designated crossings.

RIPN-6 Pile burning within Riparian Reserves may occur under the following conditions:

a. Slash piles would be placed and burned at least 50 feet outside perennial or intermittent stream channels, lakes, and ponds and 10 feet outside ephemeral drainages. Slash would not be piled on springs and seeps.

b. Fire would be allowed to creep between piles and into the "buffer areas" described in (a), maintaining a burn intensity that would protect soil and water resources.

c. Where feasible, piles would be placed in a non-linear pattern within the Riparian Reserves, maximizing the distance between piles.

d. Where feasible, burning would occur on moist soil, very moist soil, or wet soil, and when fuels are dry.

e. No more than 15 percent of any riparian reserve acre may be piled in a given year (based on an average pile diameter of 10 feet and average pile spacing of 10 feet).

f. After initial ignition of piles, but while still burning, allow each pile to be re-piled once (i.e., place large unburned pieces back into the burning pile). Additional re-piling would be allowed if necessary to achieve 80 percent consumption of the piled material.

g. Hot piling of burn piles (feeding of one pile with the material from other piles or ground material) would be prohibited within Riparian Reserves unless necessary to meet desired fuel load conditions. For example, when piles contain high proportions of large diameter material, re-piling may be necessary to achieve desired consumption.

RIPN-7 Treatments within Riparian Reserves would be limited to hand cutting (pruning and thinning), hand piling, and pile burning, and primarily backing fire underburn and broadcast burn treatments (see design feature RIPN-2 above).

RIPN-8 Dry intermittent and ephemeral stream channels may be crossed by track-mounted equipment at designated sites only after field review and approval of a qualified fisheries biologist and/or hydrologist. No perennial streams would be crossed.

RIPN-9 Effective shade over water in Riparian Reserves would not be reduced below 80 percent where it already exists.

RIPN-10 Danger trees cut down within Riparian Reserves would be retained (see SAFE-3 above). An exception is that danger trees cut in stream channels may be removed (i.e. felled) for a distance of up to 200 feet upstream of culverts. If any conifers that are danger trees greater than 12 inches dbh are cut within perennial stream channels or inner gorges, they would be left in place after consultation with district fisheries biologist and/or hydrologists. The stream channels would not be overloaded with slash.

RIPN-11 Prescribed fire would be kept at low severity in active landslide areas and inner gorges. If heavy concentrations are known to exist on either of these landforms, such sites would be evaluated in the field by geology and fuels personnel during project layout phase and appropriate mitigation measures developed to prevent high severity fire from occurring there.

Terrestrial and Amphibian Wildlife

WILD-1 Northern spotted owls:

a. Limited Operating Period – From February 1 to July 10, all activities that would generate noise above ambient levels would be prohibited; and all smoke-generating activities would be prohibited within 0.25 mile of known nest cores and suitable nesting/roosting habitat.

b. Maintain existing snag and large down log levels across the landscape where fuel loading is not excessive; do not go below Forest Plan standards for snags and logs per acre.

c. Within occupied or unsurveyed suitable habitat, no more than 50 percent of the nesting, roosting, or foraging habitat would be burned or mechanically treated in a single year in any one 7th-field watershed up to 3,500 acres in size.

WILD-2 Bald eagles:

Limited Operating Period – From January 1 to July 31, all activities within 0.25 mile of known nest sites that would generate noise above ambient levels, and all smoke-generating activities would be prohibited within 0.25 mile of known nest sites. This limited operating period may be lifted after consultation with the district wildlife biologist based on site-specific assessment of individual bald eagle nest sites.

WILD-3 Sensitive bat species:

No noise-generating or habitat modification activities would take place within 250 feet of caves, mine shafts and mine adits to protect known or potential Townsend's big-eared bat and other bat species roost sites.

WILD-4 Shasta salamander and terrestrial mollusks

a. No line construction would occur during times of potential surface activity, as determined by the district wildlife biologist, within 300 feet of limestone outcrops.

b. No mechanized equipment or pile construction would occur within 300 feet of limestone outcroppings.

WILD-5 Survey-and-manage aquatic mollusks:

No treatment would be permitted within 100 feet of springs or perennial seeps where aquatic species may be found.

Vegetation

The following design feature would apply to the cutting of any live trees greater than 14 inches diameter at breast height (dbh.). Such trees would be cut *only* if they meet the criteria for danger trees (see footnote, page 21).

VEG-1 Outside of developed recreation sites and other high-use recreation areas (see recreation design feature No. 3 below), cut live conifer stumps greater than 14 inches in diameter would be treated with a borate compound (e.g., Sporax®, Cellu-Treat®, etc.) within 4 hours of stump creation. The pesticide used would be registered with the Environmental Protection Agency and the State of California for the prevention of annosus root disease. Application of any borate compound would follow all State and Federal rules for pesticide application:

a. No borate compound would be applied within 25 feet of standing or running water.

b. No borate compound would be applied in flag-and-avoid areas to protect threatened, endangered or sensitive plants.

c. No borate compound would be applied during precipitation events.

Special Status Plants and Fungi

BOT-1 No dozer lines would be constructed within 50 feet of any documented Forest Service sensitive plant species populations. No hand lines or burn piles would be constructed and no

mechanical activities would occur within 50 feet of Forest Service sensitive plant species populations unless otherwise noted.

BOT-2 The use of mechanical equipment and the creation of piles would be prohibited within areas that have limestone outcrops to protect habitat for several species (e.g., *Ageratina shastensis*, *Neviusia cliftonii*).

BOT-3 For documented Shasta eupatory (*Ageratina shastensis*) populations not protected by the above-mentioned design features that occur within the prescribed underburn fire treatment areas, vegetation would be cut and removed by hand far enough from known populations (with the presence of a botanical monitor) to prevent injury to the plants from fire.

BOT-4 Prescribed fire treatments would not be allowed within 100 feet of known Shasta snow-wreath (*Neviusia cliftonii*) populations with the exception of occurrences selected for a monitoring study (see the project record for selection criteria). The following populations may be used in the study; however, if they are not selected for monitoring, the abovementioned design features would apply. The five snow-wreath sites are: EO 5 along Campbell Creek, EO 6 along Curl Creek, EO 7 along Low Pass Creek, EO 12 along Squaw Creek, and EO 17 along Flat Creek. Hand thinning and manual weed treatment would be permitted throughout populations with the presence of a botanical monitor.

BOT-5 In all areas where infestations of nonnative plant species occur with Shasta snow-wreath (identified in project record), the following actions and restrictions would occur where appropriate:

a. If invasive nonnative plant infestations occur adjacent to the Shasta snow-wreath occurrence (e.g., Low Pass Creek), fireline would not be constructed within 100 feet of the Shasta snow wreath occurrence.

b. Protocols for selecting specific areas with weed-adjacent rare plant populations that would be available for burning are described in the project file.

c. Post-treatment monitoring would occur for no fewer than 2 consecutive years to assess if project-related actions have resulted in increases in weed distribution or abundances. If monitoring shows that infestations have increased, manual and mechanical treatments would be conducted.

BOT-6 Hand treatments would be allowed through veiny arnica (*Arnica venosa*), northern clarkia (*Clarkia borealis* ssp. *borealis*), Butte County fritillary (*Fritillaria eastwoodiae*), and the undescribed huckleberry (*Vaccinium* sp.) occurrences with the presence of a botanical monitor. Otherwise, occurrences would be flagged and avoided with a 50-foot buffer.

BOT-7 Prescribed fire treatments would not be allowed within 100 feet of known northern clarkia (*Clarkia borealis* ssp. *borealis*), unless there is evidence, approved by the Forest botanist, that shows the impacts of prescribed fire to be neutral or beneficial.

Noxious Weeds

WEED-1 All off-road equipment used would be washed before moving into the project area to ensure equipment is free of soil, seeds, vegetative material, or other debris that may contain invasive plant seeds. Examples of off-road equipment include large dozers, chippers, chainsaws, and hand tools. Off-road equipment does not include chip vans, service vehicles, water trucks, pickup trucks, and similar vehicles not intended for off-road use. Off-road equipment would be considered clean after all plant parts and potential weed seed-carrying dirt and/or caked mud are removed.

WEED-2 Only weed-free mulches and weed-free seed sources would be used. All activities that require seeding or planting must utilize locally collected native seed sources if they are available and would be consistent with the Forest's seeding guidelines. Seed mixes must be approved by a Forest Service botanist. Staging areas for equipment, materials, or crews would be avoided in areas with heavy invasive plant infestations.

WEED-3 Construction of firelines and burn piles would not occur in or within 100 feet of invasive plant populations. Efforts would be made to reseed areas of bare soil within 100 feet of an invasive occurrence or to or cover them with vegetative material to prevent invasive plant colonization.

WEED-4 New invasive plant infestations discovered in the project area before or during project implementation would be evaluated by the botanical and weed management staff and afforded the appropriate prevention and control measures as described above.

Recreation

REC-1 Trail system features (such as bridges, signs or benches) would be protected from potential impact from prescribed fire by removing combustible material from around the feature. Any significant impacts to maintained trails (such as tread or erosion features) within the project area would be repaired as soon as possible following treatment.

REC-2 Prescribed fire would be implemented during low use recreation seasons (i.e., before Memorial Day Weekend or after Labor Day Weekend). Use of mechanical equipment (such as pumps or chainsaws) within 0.25 mile of developed recreation sites, cabins, special use permit holder facilities and private land facilities would also be limited to the low use seasons and would not commence before 7 a.m. to minimize effects to the public.

REC-3 Proposed firelines would be constructed in a manner that conceals their location (such as covering with logs, brush, rocks or forest litter) when not in use. To reduce the potential for unwanted OHV use, vegetation within 20 feet of road center along all roads proposed for treatment would be maintained with gaps of less than 4 feet where such conditions exist.

REC-4 Prescribed broadcast burning or underburning would not occur within or for a distance of 150 feet from designated boundaries of developed recreation facilities. The treatment prescription within 150 feet of developed recreation sites would allow for specific understory trees and brush (i.e., vegetation less than 10 feet high) to remain where they provide important screening and privacy between camping and picnic sites (also applies to Visual Quality). Recreation staff would assist in identifying vegetation to be treated and inspection during project implementation.

REC-5 To minimize accidental tripping injuries, tree and brush stumps would be cut flush with the ground and covered with forest litter or dirt within and for a distance of approximately 150 feet outside of designated boundaries of developed sites and in high traffic areas such as informal paths to Shasta Lake.

Special Uses (Recreation and Non-Recreation), Cooperators and Public

SUP-1 A communication plan (i.e., within the prescribed fire burn plan) would be developed for implementation of prescribed fire in the project area detailing notification procedures between the Forest Service and its cooperators, special use permit holders and the public. This would at a minimum include the following:

a. Ensuring a mutual understanding of the planned activities and the desired condition upon completion.

b. Coordinating prescribed fire with adjacent landowners and cooperators to ensure project implementation does not substantially interfere with planned, authorized or cooperator activities and permitted events (including those on Shasta Lake).

c. Displaying information signs at appropriate locations along Forest and County roads leading to resorts, marinas, boat ramps, recreation residences, communities and general forest areas while prescribed burning is in progress.

d. Temporary, low-cost interpretive displays or other information would be installed at entry stations and other key locations to explain the purpose, need and benefits of project activities, when project implementation could affect recreation users.

e. Providing a mechanism for permit holder and cooperator feedback during and following project implementation.

f. Distributing brochures that explain the purpose and need for the project to the public and permit holders.

g. Coordinating with District recreation staff to ensure a parking plan is implemented so that ingress, egress and parking for special use permit holders and the public is not substantially impacted during implementation.

Visual Quality

VIS-1 The following guidelines apply when planning prescribed underburning:

a. In areas visible from the I-5 corridor, Shasta Lake and developed recreation sites, the size of burn areas (brown/black vegetation) would be limited to 20 percent or less of the viewshed. Topographic features would be used in small drainage areas to determine burn block size, with an overall goal that individual burned areas would be approximately 250 acres or less.

b. In other areas, burn blocks would be located so they are randomly scattered throughout the entire area to minimize visual impacts in any given viewshed. Where practical, burn plans and prescriptions would be developed for treatment areas greater than 250 acres that would create a mosaic of burned and unburned areas and trend the project area toward a multi-age/multi-structure ecosystem.

VIS-2 Burn piles would be located away from leave trees to avoid crown burning. Where visible to the public (such as along roads and near recreation sites), burn pile remnants would be scattered.

Cultural Resources

Both action alternatives would follow the guidelines outlined in the 2012 Region 5 Programmatic Agreement[8] and Appendix H Region 5 Hazardous Fuels Protocol for Non-Intensive Inventory Strategies for Hazardous Fuels and Vegetation Reduction Projects. Accordingly, the following design features apply:

[8] Programmatic Agreement Among the USDA Forest Service, Pacific Southwest Region (Region 5), California State Historic Preservation Officer, Nevada State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding the Processes for Compliance with Section 106 of the National Historic Preservation Act for Management of Historic Properties by the National Forests of the Pacific Southwest Region.

ARCH-1 If any previously unrecorded cultural resources are discovered during implementation of the project, all project activities in the area would cease until a qualified archaeologist can visit and evaluate the site. Future project activities in the area may need to avoid or protect the site depending on its significance as determined by the Heritage Program Manager.

ARCH-2 All known resource cultural sites within the area of potential effect that have a National Register determination of either "eligible" or "unevaluated" would be delineated with coded flagging (pink and black striped) or other effective markings. Standard Resource Protection Measures would be implemented to eliminate or reduce potential adverse effects to at-risk historic properties, as outlined in Appendix H, 5.0 of the Programmatic Agreement.

ARCH-3 If Traditional Cultural Properties, sacred sites, or other areas of religious or cultural significance to an Indian Tribe are determined to be located within the project Area of Potential Effect (APE), formal consultation with the State Historic Preservation Officer (SHPO) would be initiated and procedures set forth in 36 CFR part 800 would be followed.

ARCH-4 Intensive inventory would be completed in portions of the project area where at risk historic properties are expected to occur and may be affected by the undertaking. In areas where vegetation is too dense to perform cultural resource inventories prior to the onset of project activities, adequate surveys would be conducted after fuels reduction project activities, as outlined in Appendix H 3.1 (c) and (d) of the Programmatic Agreement.

Monitoring

Information gathered before, during, and after we accomplish project activities is used to determine how effectively we accomplished our project objectives and design features. It provides a feedback mechanism not only for this project but for similar future projects. Monitoring is completed at recurring intervals as a basis for implementing direction in the Forest Plan. Project effectiveness monitoring is completed by routine sampling of specific projects at specified time intervals.

The following monitoring elements are specific to this project:

1. Monitoring of treatment areas would be conducted before and after all fuel reduction treatment activities; results would be documented in unit folders and placed in the project file. Monitoring would include pre- and post-treatment photos, pre- and post-treatment estimations of fuel loading, and a determination as to whether resource objectives have been met.
2. During implementation, the project would be monitored for wet weather closure needs.
3. Prescribed underburning and broadcast burning in Riparian Reserves would be monitored. If monitoring reveals that conditions are too wet for backing fire to achieve the desired objective in Riparian Reserves, options would be discussed with the project hydrologist, fisheries biologist, and soils scientist. If the prescription is modified to allow direct ignition in Riparian Reserves, monitoring would continue and would be documented in the project file. Conversely, if monitoring results show that the prescription is allowing the fire to burn too hot in Riparian Reserves, the prescription would be modified to reduce fire behavior in these areas.
4. In all areas where infestations of nonnative plant species occur with Forest Service sensitive plant species (identified in the project file), monitoring would occur for no fewer than 2 years after project implementation. If monitoring shows that infestations have increased

(distribution or abundance), manual and/or mechanical treatments would be conducted according to the weed treatment guide in the project file.

5. Agency personnel would monitor the project area to ensure that closures established for this project to prevent illegal vehicle activity are effective.
6. Prescribed underburn and broadcast burns may occur in some California snow-wreath (*Neviusia cliftonii*) or the undescribed huckleberry (*Vaccinium* sp.) populations as allowed in the project design features (see above). Populations of these two species that experience prescribed fire would be monitored after initial treatment for a minimum of 2 years.
7. Monitoring of impacts to the public would occur through feedback from the public and/or permit holders.
8. Monitoring of the treatment areas before and after treatment as described above would be used to document trends and prescribed fires affects in the California black oak target element and limestone ecosystem target element of the Devils Rock-Hosselkus RNA (USDA Forest Service 2014).

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the proposed action provided suggestions for alternative methods for achieving the purpose and need. Consideration of one issue resulted in a minor revision of the proposed action, so that full analysis of the original proposed action was deemed unnecessary. Another issue prompted consideration of an alternative that was determined to contain a component that would cause unnecessary environmental harm. This alternative was also considered, but dismissed from detailed consideration for reasons summarized below.

Original Proposed Action

The proposed action we sent to the public for comments during the scoping period included 41,816 acres of fuels treatments identical to treatments proposed under Alternative 2 (see above). With the addition of only 20 acres of hand thinning, pruning, piling and pile burning to Alternative 2, the difference in effects between the original proposed action and Alternative 2 (the revised proposed action) would not be measurable for any resources other than the recreation residences. Full consideration of the original proposed action would, therefore, be redundant.

Biomassing

One commenter, concerned about air quality during prescribed fire operations, recommended that we include biomassing to reduce the amount of fuel burned in prescribed fire. An alternative that includes biomassing was dropped from detailed study after a preliminary analysis indicated the following:

1. Lack of road access would limit the amount of biomassing that could be accomplished from existing roads. In order to substantially reduce the amount of prescribed fire through biomassing, equipment would have to travel off of established roads, which could result in unnecessary adverse impacts to resources of concern (e.g., soils, water quality and wildlife).
2. Most of the vegetation types in the project area do not produce biomass material in sufficient quantity or quality to support a biomassing operation.

3. A preliminary cost analysis indicated that biomassing to reduce fuels could cost as much as $1,200 per acre, compared with a cost of $25-$125 per acre for prescribed fire.

Comparison of Alternatives

Table 2-7 below compares treatment acres among the alternatives. Table 2-8 discloses the difference between alternatives with regard to the alternative-driving issues as described in Chapter 1.

Table 2-7. Comparison of alternatives by treatment type, in acres

Treatment Type	Alternative 1	Alternative 2	Alternative 3
Prescribed broadcast burning/underburning	0	41,625	13,247
Hand thinning, pruning, piling and pile burning adjacent to private property	0	88	28
Hand thinning, pruning, piling and pile burning around bald eagle nest sites	0	83	0
Hand thinning, pruning, piling and pile burning within recreation residence tracts	0	35	0
Dozer lines	0	4	0
TOTAL ACRES	**0**	**41,836**	**13,275**

Table 2-8. Comparison of alternatives with regard to alternative-driving issues

Issue Indicator	Alternative 1 No Action		Alternative 2 Proposed Action (Revised)		Alternative 3 No Forest Plan Amendment	
Fire Risk and Fire Hazard: Predicted crown fire and flame length potential during a wildfire *following project implementation*, expressed in percent of project area (see figures C-3 and C-4 in Appendix C)						
Changes in crown fire potential	Active crown fire	63 %	Active crown fire	4 %	Active crown fire	44 %
	Passive crown fire	6 %	Passive crown fire	8 %	Passive crown fire	5 %
	Surface fire	31 %	Surface fire	87 %	Surface fire	51 %
	Unchanged	< 1 %	Unchanged	< 1 %	Unchanged	< 1 %
Changes in flame length potential	Very high	69 %	Very High	8 %	Very High	54 %
	High	< 1 %	High	3 %	High	1 %
	Moderate	1 %	Moderate	2 %	Moderate	1 %
	Low	29 %	Low	19 %	Low	20 %
	Very low	1 %	Very low	69 %	Very low	24 %
Down Material: Predicted reduction in downed material, expressed in percent reduction from current levels, from project implementation						
Changes in downed material	No change		Up to 63% reduction on 41,836 acre		Up to 63% reduction on 13,275 acre No change on 28,561 acre	
Down Material: Post-implementation retention compared to Forest Plan (FP) minimum requirements for wildlife species addressed in this analysis (Appendix G of the Forest Plan)						
FP minimum requirements Fisher 5-10 tons/acre Marten 5-35 tons/acre NSO 10-20 tons/acre	No change		5-15 tons / acre on 41,836 acre		5-15 tons / acre on 13,275 acre No change on 28,561 acre	
Standing Snags – Predicted change in snag numbers from implementation of the alternatives, based on the percent of treated acres predicted to experience very high or high flame lengths and active crown fire *during project implementation (see figures C-5 and C-9 in Appendix C)*						
Numbers of standing snags	No change		Very high flame lengths	< 1 %	Very high flame lengths	< 1 %
			High flame lengths	< 1 %	High flame lengths	< 1 %
			Active crown fire	0 %	Active crown fire	0 %
			No net change in snag numbers		No net change in snag numbers	

% = percent; < = less than

Chapter 3. Affected Environment and Environmental Consequences

This chapter discloses the affected environment and environmental effects for those resources that may be affected by project activities; those resources for which key issues were identified from the public and/or interdisciplinary team during scoping (noted in chapter 1); and those key resources that have protection based on environmental laws, regulations and/or polices. This chapter also analyses the proposed site-specific, non-significant Forest Plan amendment as directed in Forest Service Handbook 1909.12. 25.4 (USDA Forest Service 2006) and impact topics required under 40 CFR 1502.16. The analysis is based on best available science.

Direct environmental effects are those occurring at the same time and place as the initial cause or action. Indirect effects are those that occur later in time or are spatially removed from the activity, but would occur in the foreseeable future. Cumulative effects result when the incremental effects of actions are added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place over a period of time. Past, present, and reasonably foreseeable future actions are assessed along with the effects of the proposed action and alternatives to determine whether significant cumulative effects may occur.

Approach to Cumulative Effects Analysis

Spatial and temporal boundaries are the two key elements to consider when deciding which actions to include in a cumulative effects analysis. Spatial and temporal boundaries set the limits for selecting those actions that are most likely to contribute to a cumulative effect. The effects of those actions must overlap in space and time for there to be potential cumulative effects (FSH 1909.15 (15.2)). Therefore the relevant boundaries and projects assessed for cumulative effects vary by resource. Each resource's cumulative effect area can be different and possibly larger or smaller. Relevant cumulative effects are documented for the resource in the project specialist reports and summarized in this chapter. The cumulative effects analysis for each environmental component or resource area is guided by and consistent with the Council on Environmental Quality letter "Guidance on the Consideration of Past Actions in Cumulative Effects Analysis" of June 24, 2005. The current environmental conditions on the landscape reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects and can be used as a proxy for the impacts of past actions (§ 220.4 (f)). For each resource area, direct and indirect effects of the proposed action were reviewed, in accordance with the Forest Service Handbook, and relevant spatial and temporal boundaries for cumulative effects analysis were determined. The longest relevant temporal boundary in this review was 20 years, as this bounding captures both short term impacts and the long term effectiveness of treatment.

For the Green-Horse project, the cumulative effects analysis considers the project area boundary as the furthest extent of effects for all alternatives. Because the project area is so large, the project area boundary itself captures the cumulative impacts that may overlap in space and time with proposed activities within each treatment unit within the temporal bounding of this analysis. The Green-Horse project area encompasses approximately 42,836 acres, and as such, is within three 5th field watersheds and encompasses all or part of sixteen 7th field watersheds. Appendix A contains a description of past, current, ongoing and reasonably foreseeable actions that were considered in determining cumulative effects for various resources. While there would be no

cumulative effects from no action (Alternative 1) based on the definition provided in 40 CFR 1508.7,[9] the long-term effects of this alternative when combined with past, present and reasonably foreseeable actions were discussed for all resources.

Wildfire and Fuels[10]

This section addresses the predicted fire behavior during project implementation and the effects of the alternatives on future fire behavior. The time period for analysis of cumulative effects is 20 years from completion of project activities. Beyond this time period the effectiveness of fuels treatments would be predicted to diminish, considering the continued Forest policy of suppression of all fires.

Affected Environment

Fire History

Few forested regions have historically experienced fires as frequently and with such high variability in fire severity as the Klamath Mountains Bioregion (Taylor and Skinner 1998). On the eastern edge of the Klamath Mountains, where the project area is located, median fire return intervals ranged from 8 to 38 years (Skinner 2006). With frequent fire of low to mixed severity, fuel accumulations over most of the area were historically maintained at low levels, and landscape features such as ridge-tops and streams were often sufficient to impede fire spread (Skinner 2006).

Historically, approximately 74 percent of the analysis area supported vegetation at or below a fire return interval of 20 years (Fire Regime I).[11] See table 3-1 below.

Table 3-1. Historic fire return intervals (FRI) on NFS lands in the project area

Historic FRI (years)	Acres	Percent of Area
≤ 20	30,809	74%
>20 and ≤ 35	6,721	16%
> 35 and ≤ 60	4,306	10%

≤ = less than or equal to; > = greater than; % = percent

According to Shasta-Trinity National Forest GIS data, twenty-seven fires of 1,000 acres or more have occurred in or near the project area over an 87-year period (1924 to 2011). Over the last 31 years (1981 to 2012) approximately 360 fire starts have occurred in watersheds within the project area.

[9] 40 CFR 1508.7 states that '"Cumulative impact" is the impact on the environment which results from the incremental impact of [an] action when added to other past, present, and reasonably foreseeable future actions…'

[10] The Wildfire and Fuels section of this DEIS summarizes information contained in the Green-Horse Fire, Fuels, Air Quality and Vegetation Report. The report is incorporated by reference and is part of the project record located at the Shasta Lake Ranger Station.

[11] Based on Fire Regime Interval Departure GIS data provided by the Region 5 Ecology Program

Since the onset of fire suppression in the early 1900s, and with the increased effectiveness of mechanized suppression techniques (fire engines, aircraft, etc.) in later years, most fires were kept small until recently. As demonstrated by figure 3-1 and table 3-2 below, fire has been effectively excluded from the project area for almost 80 years.

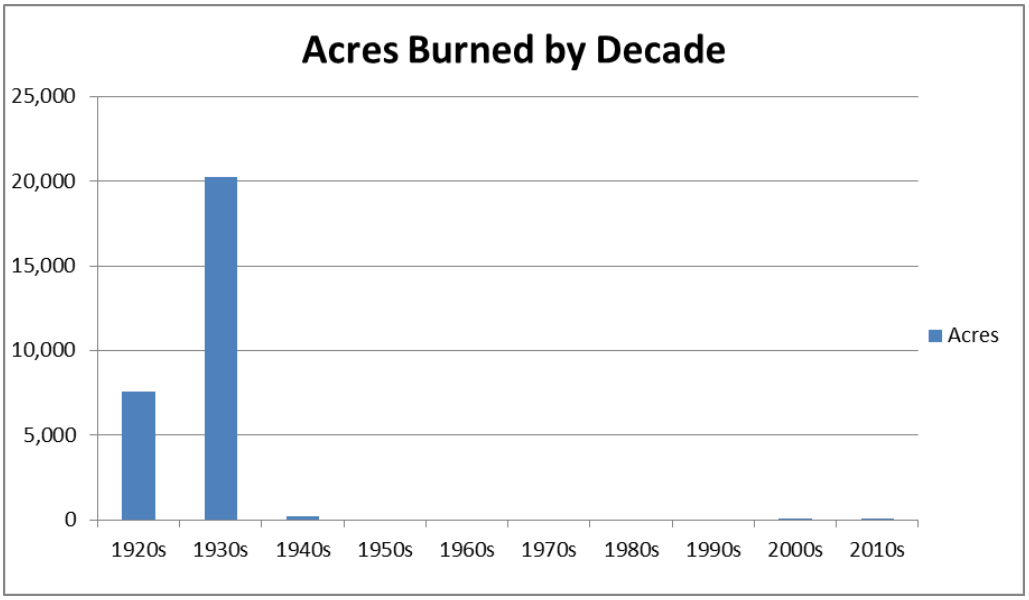

Figure 3-1. Acres burned by wildfire in the Green-Horse project area since 1920, by decade

Table 3-2. Acres burned by wildfire in the Green-Horse project area since 1920, by decade

Decade	Acres Burned
1920s	7,592
1930s	20,239
1940s	247
1950s	0
1960s	0
1970s	0
1980s	0
1990s	0
2000s	51
2010s	5
Total	**28,134**

With successful fire suppression fuel and vegetation densities have increased, and recent fires on the Shasta-Trinity National Forest have become more intense and difficult to control. While fire has been virtually non-existent within the project area itself, the surrounding landscape has experienced recent large, often severe fire activity. Examples of these fires, which are described in detail in the project Fire and Fuels Report, include the following:

- 1990 Bear 1,440 acres
- 1992 Fountain 60,250 acres

• 1999	High Complex	38,086 acres
• 1999	Jones	26,202 acres
• 2004	Bear	10,400 acres
• 2008	SHU Lightning Complex	86,500 acres
• 2012	Bagley Complex	46,011 acres

Figure C-2 in Appendix C displays the fire history of the Green-Horse project area.

Existing Condition

Fire Environment of Project Area

Climate

The climate of the project area is described as Mediterranean, characterized by wet, cool winters and dry, warm summers. Mean annual precipitation varies from approximately 70 inches in the upper portions of the watersheds to nearly 40 inches at the lower end. About 90 percent of the precipitation falls between October and April, the majority of which occurs as rain with very little snowpack. Summer thunderstorms are common and can release significant localized rain. These storms can also be dry with conditions that encourage fire ignition and spread from lightning strikes, with an event in June of 2008 being the latest example of this pattern.

Fire, Fuels and Vegetation in Climate Change

Fire suppression has led to fuel-rich conditions, and most future climate modeling predicts climate conditions that will likely exacerbate these conditions, thus increasing the likelihood of large fire occurrence. Westerling and others (2006) showed that increasing frequencies of large fires (>1000 acres) across the western United States since the 1980s were strongly linked to increasing temperatures and early spring snowmelt.

Rising temperatures, changing precipitation patterns and declining soil moisture trends have shifted the suitable range for many tree species to higher elevations. With higher rainfall to snowfall ratios and higher nighttime minimum temperatures, broadleaf trees (especially oak species) are predicted to become an increasingly important component of conifer-dominated forests. Higher temperatures also correlate with longer summer drought conditions which, in turn, increase drought stress on seedlings and increase wildfire risk. Recent research results indicate that mitigating increased disturbance from high-severity wildfires while promoting species diversity is the likeliest strategy to enhance ecosystem resilience in the face of climate change (Skinner 2007).

See the climate change analysis beginning on page 173 for a detailed discussion.

Vegetation

Vegetation in the project area is described in further detail in the Vegetation section of this chapter. Fire suppression policies over the last century have led to unnaturally dense vegetation conditions that are beyond the historic range of natural variability. The current vegetation conditions, combined with large inter-annual to decadal fluctuations of precipitation, are conducive to large-scale disturbances such as wildland fire and insect and/or disease outbreaks.

In an historic setting the species composition and density levels would be different from what occurs today (Show and Kotok 1924). Fire suppression policies in the project area have created

dense stands comprised primarily of shade-tolerant species in a landscape that historically had more open stands of primarily shade-intolerant, fire-adapted species as a result of frequent low-intensity fires. In the absence of low-intensity fire that would have generally consumed surface fuels (downed wood) and live fuels (ladder fuels), both fuel types have increased.

Departure from Historic Fire Return Intervals (Condition Class)

Departure from historic fire return intervals is used to indicate the number of disturbances that a site has missed and is used as a method to determine ecological functionality within an ecosystem. The condition class on a given portion of the project area as measured by the departure from historic fire return intervals is documented in Figure 3-2 below. Approximately 91 percent of the project area has missed at least three fire intervals, with some areas having missed as many as six intervals.

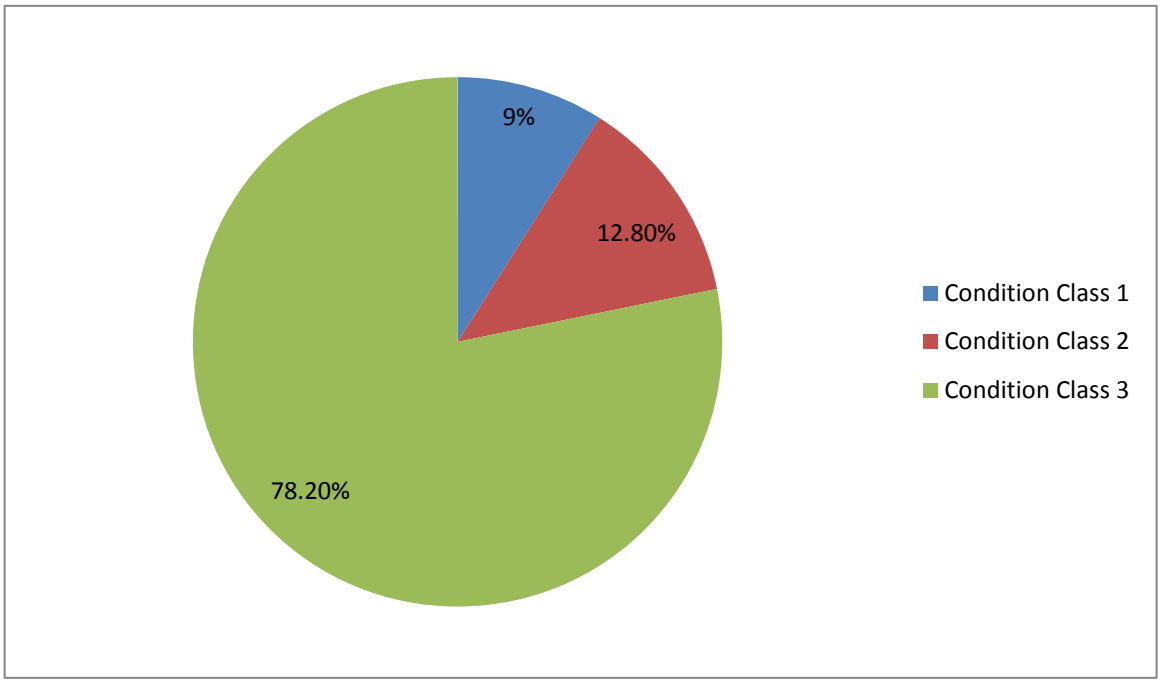

Figure 3-2. Current status relative to historic reference conditions (condition class) based on fire return interval departure, expressed as a percentage of the project area.

Fuels

To model and predict fire behavior, fuels are often separated into fuel models that are mathematically entered into a fire spread calculation.[12] GIS data supplied by the California Fuels Landscape (i.e. fuel models derived from vegetation data) were obtained to analyze current fuel models within the project area. The fuel models (Scott and Burgan 2005) and the extent of their occurrence in the project area are described in table 3-3 below.

[12] Based on Rothermel 1972

Table 3-3. Fuel model descriptions on NFS lands by acres and percentage of project area

Fuel Model and Category	Description	Acres of fuel model in project area	Percent of project area
Non-Burnable Fuel Models (NB)			
98 99	Non-burnable. For example, , urban development or bare ground	361	<1%
Grass Fuel Models (GR)			
101 102 104 107	The primary carrier of fire in the GR fuel models is grass. Fuels can vary from heavily grazed stubble to sparse natural grass to dense grass more than 6 feet tall. Spread rate and flame length varies from moderate to extreme	345	<1%
Grass-Shrub Fuel Models (GS)			
121 122	The primary carrier of fire in GS1 is grass and shrubs combined. Shrubs are about 1 foot high, grass load is low. Spread rate is high; flame length moderate.	1,167	2.5%
Shrub Fuel Models (SH)			
141 SH1	The primary carrier of fire in SH1 is woody shrubs and shrub litter. Low shrub fuel load, fuelbed depth about 1 foot; some grass may be present. Spread rate is high; flame length moderate.	191	<1%
142 SH2	The primary carrier of fire in SH2 is woody shrubs and shrub litter. Moderate fuel load (higher than SH1), depth about 1 foot, no grass fuel present. Spread rate is moderate; flame length moderate.	620	1.3%
145 SH5	The primary carrier of fire in SH5 is woody shrubs and shrub litter. Heavy shrub load, depth 4-6 feet. Spread rate is very high; flame length very high.	1,245	2.7%
147 SH7	The primary carrier of fire in SH7 is woody shrubs and shrub litter with a depth of 4 to 6 feet. Spread rate is high and flame length is very high.	2,266	4. 9%
Total percentage of SH models in project area			**10%**
Timber-Understory Fuel Models (TU)			
161 TU1	The primary carrier of fire in TU1 is a low load of grass and/or shrub with litter. Spread rate is low and flame	1,164	2.5%

Fuel Model and Category	Description	Acres of fuel model in project area	Percent of project area
	length is low.		
164 TU4	The primary carrier of fire in TU4 is short conifer trees with grass or moss understory. Spread rate is moderate and flame length is moderate.	767	1.7%
165 TU5	The primary carrier of fire in TU5 is heavy forest litter with a shrub or small tree understory. Spread rate is moderate; flame length high.	6,236	13.5%
Total percentage of TU fuel models in project area			**18%**
Timber-Litter Fuel Models (TL)			
181 TL1	The primary carrier of fire in TL1 is compact forest litter. Light to moderate load, fuels 1 to 2 inches deep. Spread rate and flame length is very low	2,357	5.1%
182 TL2	The primary carrier of fire in TL2 is broadleaf (hardwood) litter. Low load, compact broadleaf litter. Spread rate is very low; flame length very low.	590	1.3%
183 TL3	The primary carrier of fire in TL3 is moderate load conifer litter, light load of coarse fuels. Spread rate is very low; flame length very low.	5,691	12.3%
184 TL4	The primary carrier of fire in TL4 is moderate load of fine litter and coarse fuels. Includes small diameter downed logs. Spread rate is low; flame length low.	7,295	15.8%
185 TL5	The primary carrier of fire in TL5 is high load conifer litter, light slash or mortality fuel. Spread rate and flame length is low.	23	<1%
186 TL6	The primary carrier of fire in TL6 is moderate load broadleaf litter, less compact than TL2. Spread rate is moderate; flame length low.	475	1%
188 TL8	The primary carrier of fire in TL8 is moderate load long-needle pine litter, may include small amount of herbaceous load. Spread rate is moderate; flame length low.	12,597	27.2%
189 TL9	The primary carrier of fire in TL9 is very high load, fluffy broadleaf litter. TL9 can also be used to represent heavy needle-drape. Spread rate is moderate; flame length moderate.	2,967	6.4%

Fuel Model and Category	Description	Acres of fuel model in project area	Percent of project area
Total percentages of timber litter fuel models in project area			**69%**
Descriptions based on Anderson 1982 and Scott and Burgan 2005. Fuel models derived from the California Fuels Landscape created by the Region 5 Stewardship and Fireshed Analysis Team and clipped to the analysis area in GIS (Anderson 1982, Scott and Burgan 2005).			

< = less than; % = percent

Fire Behavior

Flame Length Potential

Flame length serves as a measure of how intense a fire may become and as a proxy for ease of fire suppression to model and predict fire behavior. Flame lengths are described in the Fire Management Plan and Appendix B of the Fireline Handbook (NWCG 2006) and are defined as follows:

Very Low – Non-flammable areas such as rock outcropping, water, etc.
Low – Flame lengths 0 to 4 feet. Tactics using hand tools can generally attack fires at the head or flanks of the fire with success.
Moderate – Flame lengths 4 to 8 feet. Fires are too intense for direct attack on the head of the fire with hand tools. Equipment such as dozers, engines and retardant aircraft can be effective.
High – Flame lengths 8 to 12 feet. Fires may present serious control problems such as torching, crowning, and spotting. Control efforts at the head of the fire will probably be ineffective.
Very High – Flame lengths greater than 12 feet. Fires present serious control problems and control efforts are typically ineffective.

Crown Fire Potential

Crown fire potential is a measure of how intense or extreme a fire may become under specified conditions. Canopy characteristics (e.g. canopy base height, canopy bulk density, stand height, and foliar moisture content), ladder fuels, and fuel loading are all factors that determine crown fire potential. The model assumes uniform canopy characteristics and makes independent fire behavior calculations for each raster landscape (90 m X 90 m cell). As a result of these assumptions, the model frequently under-predicts active crown fires (Fule et al. 2001, Scott and Reinhardt 2001, Cruz et al. 2003, Stratton 2004). Crown fire measures are defined as the following:

Surface fire -- The fire remains on the forest floor. The combination of surface fire intensity and ladder fuels is not sufficient to move a fire into the crowns under the defined burning conditions.
Passive Crown Fire -- Individual tree or group torching occurs. The combination of surface fire intensity and ladder fuels allows for movement into the crowns under the defined burning conditions, but canopy bulk density is too low for fire to spread through the crowns under the projected wind speeds.
Active Crown Fire -- The combination of surface fire intensity, ladder fuels and canopy bulk density allows fire to move into, and spread through, the crowns under the defined burning conditions.

Fire Risk, Fire Hazard and Values at Risk

The Shasta-Trinity National Forest undertook a re-examination of the integrated vegetation management process in 2009.[13] This process, known as the Integrated Vegetation Management Strategy, characterizes vegetation and its inherent availability to burn in a wildfire. A hazard, risk, and value analysis was used for this strategy. Hazard is defined as fire behavior potential, which has implications for resource effects as well as suppression capability. Risk is the likelihood of a fire occurring based on wildfire history. Value refers to the monetary, ecological or political significance of a defined area.

The analysis concluded that the Green-Horse project area and many adjacent lands are considered a high priority for treatment over the next five years. In other words, the existing conditions ranked high in terms of risk, hazard and value.

Environmental Consequences

Alternative 1 - No Action

Direct, Indirect and Cumulative Effects

Under the No Action alternative, current management activities in the project area would continue. With no change in current management of the project area under the No Action alternative, there would be no direct effects.

The continued accumulation of untreated fuels would increase the potential of high-severity fire within the project area. Age class diversity would continue to decrease and would remain similar to current conditions, with the potential of high-severity fire exacerbating this trend. This scenario is illustrated by the previously described recent fire history – notably the Fountain, Jones and Bear fires – where moderate- to high-severity fire effects were exhibited.

The fire behavior resulting from unusually high accumulation of fuels (such as high live to dead fuel ratios) increases a fire's intensity and the probability of spotting. It also produces a more challenging fire environment for firefighters to work in (e.g. increased threat from rolling material and snags) that are beyond what historically occurred.

Current management for the project area is limited to direct fire suppression and does not specify treatments of fuel accumulations through management of wildfires for resource benefit. Under this alternative, therefore, the existing fuel accumulations would not be addressed. Fuels and understory vegetation would continue to accumulate and to exacerbate fire hazard.

As time passes, falldown of standing material would continue to increase the surface fuel loading, particularly of larger diameter material. This downed coarse woody debris would exhibit some decay and would support a long period of burning, resulting in high burn severity where large woody material is present. In addition, regeneration of vegetation would provide a continuous surface fuel bed and ladder fuels that promote fire spread and increase crown fire potential.

Currently the fuel loading within the project area is estimated to be as high as 75 tons per acre and, when combined with recruited material from the current stand, the fuel loading may

[13] The complete analysis is part of the Shasta-Trinity National Forest Fire Management Plan; Fuels Management Reference Section II (USDA Forest Service 2013)

increase by 25-35 tons per acre – with a large portion of the overall fuel loading being in larger size classes.

The continued accrual of fuels within the project area would present problems to fire managers by increasing the intensity of fires that occur, flame lengths and crown fire potential. This is often described by an adjective rating referred to as "resistance to control", which is an estimate of the fire suppression forces required to control a unit of fire perimeter (Brown 1995). Brown (1995) indicated that large diameter fuel loading exceeding 45 tons per acre is defined as "extreme" resistance to control, with a "high" rating ranging from 25 to 45 tons per acre. Resistance to control can be measured through live-to-dead fuel ratios as well as dead fuel loading. The No Action alternative would maintain or perhaps increase resistance to control by promoting a fire environment characterized by copious amounts of large diameter fuels and snags and understory vegetation that provides continuous surface fuels and ladder fuels.

Implementation of no action – when combined with ongoing fire suppression – would have adverse effects on future fire management activities by promoting the accumulation of fuels at levels that would increase the size, intensity and severity and resistance to control of future wildfires. Implementation of this alternative would, therefore, increase the risk to firefighter and public safety and the potential for adverse effects to natural resource and cultural values during future wildfires. In addition, the potential of fire spread to and from the project area would increase.

Historically, approximately 73 percent of the analysis area supported vegetation at or below a fire return interval (FRI) of 20 years (Safford et al. 2011). Given the historical FRI, the process to re-establish fire's natural role would be estimated to be between 40 and 60 years without any management influence – including prescribed fire and suppression of wildfires. However, in the absence of active management to reduce fuels, the Forest Service would have few options to manage future wildfires for resource benefits. The policy of suppressing all fires would continue, which would further contribute to fire behavior and effects that are beyond what occurred historically. It is unlikely that a more historically accurate fire regime would return to the landscape, and future fires would likely produce unacceptable effects to resource values in the project area.

The potential for fire behavior to exceed most ground suppression capabilities under this alternative is high, with approximately 70 percent of the landscape producing flame lengths greater than 8 feet. Mortality and canopy loss, as portrayed by crown fire potential, is expected to approach 70 percent as well. These values illustrate the difficulty that fire managers would have in suppressing such fires and the increased probability of adverse resource effects. Predicted fire behavior values for a future wildfire event occurring under 90th percentile conditions are displayed in table 3-4 below and depicted in Figures C-3 and C-4 in Appendix C.

Table 3-4. Current crown fire and flame length potential on NFS lands in the project area under 90th percentile parameters. These data represent predicted future fire behavior values under no action.

Crown Fire Potential	Unburned	Surface Fire	Passive Crown Fire	Active Crown Fire	
(acres, %)	283 (<1%)	13,027 (31%)	2,462 (6%)	26,064 (63%)	
Flame Length Potential	**Very Low**	**Low**	**Moderate**	**High**	**Very High**
(acres, %)	511 (1%)	12,132 (29%)	608 (1%)	69 (<1%)	28,516 (69%)

< = less than; % = percent

Implementation of this alternative would not complement existing fuel treatments, most notably the Green Mountain Vegetation Management Project, leaving a large landscape still prone to high-intensity wildfire. Additionally, the added benefit of treating the increased fire hazard across a broad landscape in conjunction with other fuels reduction projects adjacent to this project area would not be realized. Although these other projects are not directly related to the Green-Horse project, they do serve a common goal of reducing the adverse impacts of fire to the landscape as a whole.

Alternative 2 – Proposed Action (Revised)

Direct and Indirect Effects

This alternative includes 41,836 acres of fuels treatments that would be accomplished over 7 to 10 years using an adaptive management strategy. It would require amending the Forest Plan to change down wood requirements in order to achieve fuel reduction objectives and protect soils in specific management prescription areas. The qualitative discussion of direct and indirect effects applies to the treated areas under Alternatives 2 and 3, and is presented below under Effects Common to Both Action Alternatives. Table 3-5 below displays the direct effects of Alternative 2 on crown fire and flame length potential with regard to the prescribed fire treatments and the indirect effects with regard to predicted future fire behavior. These effects are depicted in figures C-5 through C-8 in Appendix C.

Table 3-5. Crown fire and flame length potential for prescribed fire (30th to 60th percentile) and post-treatment wildfire (90th percentile) under Alternative 2

Alt 2 Rx Fire	**Crown Fire Potential (acres, %)**	**Unburned**	**Surface Fire**	**Passive Crown Fire**	**Active Crown Fire**	
		283(<1%)	37,640 (90%)	3,913 (9%)	0 (0%)	
	Flame Length Potential (acres, %)	**Very Low**	**Low**	**Moderate**	**High**	**Very High**
		23,398 (56%)	18,205 (43%)	106 (<1%)	30 (<1%)	97 (<1%)

Alt 2 Rx Fire	Crown Fire Potential (acres, %)	Unburned	Surface Fire	Passive Crown Fire	Active Crown Fire	
Alt 2 Wildfire	Crown Fire Potential (acres, %)	Unburned	Surface Fire	Passive Crown Fire	Active Crown Fire	
		283 (<1%)	36,424 (87%)	3,463 (8%)	1,666 (4%)	
	Flame Length Potential (acres, %)	Very Low	Low	Moderate	High	Very High
		28,860 (69%)	7,806 (19%)	901 (2%)	1,101 (3%)	3,168 (8%)

Alt = Alternative; Rx = Prescribed; % = percent; < = less than

Alternative 3 – No Forest Plan Amendment

Direct and Indirect Effects

This alternative includes approximately 13,275 acres of fuels treatments that would be accomplished over 7 to 10 years using an adaptive management strategy. It would not require amending the Forest Plan to change down wood requirements as defined in Alternative 2. As noted above, the qualitative discussion of direct and indirect effects applies to the treated areas under both action alternatives and is presented below. Table 3-6 below displays the direct effects of Alternative 3 on crown fire and flame length potential with regard to the prescribed fire treatments and the indirect effects with regard to predicted future fire behavior. These effects are depicted in maps C-9 through C-12 in Appendix C.

Table 3-6. Crown Fire and flame length potential for prescribed fire (30th to 60th percentile) and post-treatment wildfire (90th percentile) under Alternative 3

Alt 3 Rx Fire	**Crown Fire Potential (acres, %)**	**Unburned**	**Surface Fire**	**Passive Crown Fire**	**Active Crown Fire**	
		28,591 (68%)	12,391 (31%)	601 (1%)	0 (0%)	
	Flame Length Potential (acres, %)*	**Very Low**	**Low**	**Moderate**	**High**	**Very High**
		8,891 (21%)	4,337 (10%)	21 (<1%)	6 (<1%)	20 (<1%)
Alt 3 Wildfire	**Crown Fire Potential (acres, %)**	**Unburned**	**Surface Fire**	**Passive Crown Fire**	**Active Crown Fire**	
		283 (<1%)	21,189 (51%)	2,099 (5%)	18,265 (44%)	
	Flame Length Potential (acres, %) **	**Very Low**	**Low**	**Moderate**	**High**	**Very High**
		10,087 (24%)	8,291(20%)	446 (1%)	359 (1%)	22,653 (54%)

Alt = Alternative; Rx = Prescribed; % = percent; < = less than

*Flame length potential under Alternative 3 is disclosed for the acres treated, with the percentage based on the sum of the treated and untreated acres. There is no predicted flame length potential for the untreated (i.e. unburned) acreage during project implementation.

**Flame length potential predicted for a wildfire following implementation of Alternative 3 is disclosed both for the treated and untreated acres, with the percentage based on the sum of the treated and untreated acres.

Effects Common to Alternatives 2 and 3

Direct Effects

The moderated conditions under which prescribed fire would be implemented would safely reduce fuels accumulated from decades of fire suppression as well as increase age class diversity (see the Vegetation section of this chapter) within the treated areas. Both action alternatives would be predicted to reduce the total fuel available in the treated areas by as much as 63 percent, with large diameter fuels predicted to be reduced by as much as 58 percent, trending the project area towards a historical range of variability and the desired condition.

There are risks associated with the use of prescribed fire. Escaped prescribed fire may cause unintended resource and economic damage. However, these occurrences are extremely rare relative to the large number of prescribed fires that are successfully conducted (Russell et al. 2004). Implementing prescribed fire when climatic and fuel variables are considered optimal for the desired fire behavior increases the likelihood of successfully meeting objectives and reduces the risk of escaped prescribed fire. Given project design features (FIRE-1) the risk of escape prescribed fire under either action alternative is very low.

Indirect Effects

The beneficial effects of prescribed fire on altering fuel structure and future wildfire behavior and effects have long been observed and reported (Finney 2001, Stratton 2004, Vaillant et al.

2006). The proposed treatments were designed to optimize the effectiveness of future fire suppression efforts and to reduce the impacts of future fires on natural resources and the public.

The severity of fire effects and difficulty of fire suppression in future fires are primarily associated with the total amount of fuel available (Skinner 2002) and environmental hazards to firefighters. As noted above, either action alternative would reduce current total fuel loads by as much as 63 percent and large diameter fuels by as much as 58 percent in the treated areas. Reducing fuels that have accumulated since the onset of the suppression era would greatly reduce both the likelihood of crown fire and predicted flame length (a corollary for resistance to control).

Modeling using FlamMap indicates that up to approximately a 90 percent reduction in the potential for active crown fire in the treated areas would result from implementation of either action alternative given a wildfire under 90th percentile conditions following implementation. Within the project area flame lengths exceeding 8 feet would be reduced by 85 percent from the existing condition, with a significant increase in areas where flame lengths would be less than 4 feet (80 percent as compared to 30 percent under current conditions and the no action alternative). In the treated areas, challenges to future fire suppression operations would be reduced through the controlled consumption of large diameter fuels, snags and ladder fuels that contribute to higher resistance to control.

Conclusion

Under either action alternative, future wildfires within the treated areas would play a role more similar to that of historic conditions than under current conditions. Reduced future fire behavior, fire intensity and the resulting fire severity and resistance to control in the treated areas would be expected. Conducting prescribed fire operations as proposed would begin to restore fire to the ecosystem in a more controlled manner, thus expediting a return to the historic fire regime. The gradual reduction in accumulated fuels would reduce the adverse impacts of future wildfires on resources and the public while promoting the resource benefits of a more natural fire regime. Additional benefits would accrue when considering ongoing and foreseeable actions as described below.

Implementation of either action alternative, besides moderating fire behavior in the treated areas, would reduce the risk that a wildfire originating from within the treated areas would threaten adjacent public and private lands. When combined with ongoing projects (e.g. the Green Mountain Vegetation Management Project) and other current and future projects, at least some degree of collective benefit of reducing fire hazard across a broad landscape could be realized under either action alternative.

While fire suppression would continue in accordance with Forest policy and direction, the predicted improved fuel conditions in the treated areas would promote more self-regulated fire behavior, thereby reducing suppression costs and risks to firefighters and the public. Both action alternatives would have beneficial effects to fire and fuels management by trending the areas treated toward historic fuel conditions.

Implementation of either action alternative would provide a safer environment for firefighters and reduce the adverse effects to natural resources and the public from future wildfires. With reduced fire behavior conditions in strategic locations future fires would be more manageable, with a suite of options available to fire managers to limit fire size and reduce suppression costs

and risks to firefighters. Managing fuels through prescribed fire as proposed may facilitate future management of wildfires within the eastern portion of Shasta Lake for resource benefit.

Cumulative Effects

The cumulative effects of Alternatives 2 and 3 are essentially the same for the areas treated under both alternatives are therefore discussed together. However, the elimination of 28,561 acres of treatment within the project area under Alternative 3 would reduce the overall effectiveness of the treatments but would result in improved fuel conditions on a smaller landscape. When combined with ongoing fire suppression, the untreated portions of the project area would likely experience effects similar to those of Alternative 1 (No Action) in a future wildfire. Appendix A contains a description of past, current, ongoing and reasonably foreseeable actions that were considered for this cumulative effects analysis. None of these actions will overlap in space and time with the Green-Horse project to cause additive, negative impacts to the fuels within project area.

Vegetation[14]

This section addresses the effects of the proposed alternatives on the following categories of vegetation in the project area: **native vegetation, special status plants and fungi, and invasive or noxious weeds.**

Bounding

The cumulative effects analysis for vegetation considers the project area boundary as the furthest extent of effects for all alternatives. The time period for analysis of cumulative effects is 20 years from completion of project activities or, in the event of selection of the No Action Alternative, 20 years from the date of the decision. This time period reflects the estimated duration of the effectiveness of the proposed treatments in reducing future fire behavior.[15]

Native Vegetation Affected Environment

This section addresses vegetation communities in a historic and present day context to frame a discussion of the vegetation environment and potential consequences of the alternatives.

Methodology for Affected Environment

Vegetation within the project area was analyzed using GIS vegetation mapping to identify key attributes including distribution of vegetation communities, forest seral stage and density as measured by canopy closure. Vegetation attributes were further analyzed in context of environmental attributes including soils characteristics, elevation, and topography as well as historic fire regime and predicted fire behavior.

Broad-level ecological classification of the project area is derived from 'Description of the Ecoregions of the United States' (USDA Forest Service 1995a). Vegetation is further classified into Regional Dominance types (USDA Forest Service 2008) using GIS vegetation mapping data from the 2007 CALVeg Eveg layer (USDA Forest Service 2007). These provide an ecological

[14] The Vegetation section of this DEIS summarizes information contained in the Green-Horse Fire, Fuels, Air Quality and Vegetation Report, Biological Evaluation for Sensitive Plant Species and Supplementary Botany Report. The reports are incorporated by reference and are part of the project planning record located at the Shasta Lake Ranger Station.

[15] See the project Fire, Fuels, Air Quality, and Vegetation report in the project record

classification of vegetation groupings that commonly occur together within geographic areas and elevation zones, and share a common developmental pattern of seral stages. Seral stages were assigned to all vegetation types that included a tree component based on the mapped average overstory tree diameter, canopy cover, species developmental characteristics and considering disturbance intervals. The distribution of vegetation types, densities and seral stages was analyzed in the context of fire history and condition class data to determine current vegetation conditions in the context of the fire history. This in turn helps provide the context in which to analyze the potential effects to vegetation under the proposed action and the alternatives.

Historical Vegetation

The most prominent influence on vegetation within the project area prior to European settlement was recurring wildfire. Most of the project area had a historical fire regime of frequent low- to moderate-intensity fire. Historic natural fire regimes and fire return intervals are discussed in detail above in the Wildfire and Fuels section.

While precise historic vegetation distribution is not known, documented fire history and development of post- settlement vegetation conditions provide valuable clues. Vegetation mapping and written accounts of lands adjacent to Shasta Lake (the southern portion of the project area) from the late 1930s to the 1940s indicated that much of the area was composed of open-canopied stands, while over a third of the area was in shrub or chaparral vegetation cover (USDA Forest Service 1938, USDI Bureau of Reclamation 1947). Much of the area had been extensively logged beginning in the late 1880s, such that most merchantable timber had been removed except in areas where access was limited. Table 3-7 below displays the change in vegetation types from 1938 to the present.

Table 3-7. Change in vegetation type distribution, 1938 to present, within the southern portion of the project area

Vegetation Type	Percentage of vegetation types (1938)	Percentage of vegetation types (present day)
Shrub / Chaparral	40%	12%
Forested – conifer and/or hardwood	57%	87%
Undefined / non-forest	3%	1%

Based upon these conditions and a historical fire regime of frequent low- to moderate-intensity fire, much of the vegetation prior to European settlement was likely fairly open-canopied with brush, forbs and grasses underneath. Denser stands of mixed conifers would likely have been present at higher elevations, along riparian corridors and on north-facing slopes where local moisture levels are higher and fires were less frequent.

Existing Vegetation Conditions

Vegetation Types

The geographic information systems (GIS) layer used for analysis - which was obtained from the U.S. Forest Service Region Five Remote Sensing Lab - contains various attributes by which vegetation is classified. For the purposes of this report, CalVeg Regional Dominance Type (USDA Forest Service 2007) was selected to identify and quantify vegetation within the project area. The CalVeg Regional Dominance types are two letter codes used in mapping distinct

vegetation communities. These regional dominance types are further refined and described as vegetation alliances based on their geographic location or CalVeg Zone.

Vegetation communities in the project area are predominantly mixed conifer and hardwood forests that are considered foothill/lower montane vegetation types based on the elevation range and species mix. Roughly 90 percent of the project area is forested. The remaining 10 percent of the project area is predominantly shrubs and chaparral, and includes herbaceous and non-vegetated areas. Table 3-8 below displays the vegetation types that occur within the project area.

Table 3-8. Acres of vegetation by CalVeg Regional dominance type and category in the project area

Regional dominance type symbol	Alliance name	Acres	Percentage of project area
Conifer Forest/Woodland Category:			
DF	Pacific Douglas-fir	2,514	6%
DW	Douglas-fir White fir	3	<1%
KP	Knobcone Pine	607	1%
MP	Mixed Conifer- Pine	1,805	4%
DP	Douglas-fir Ponderosa Pine	15,185	36%
PD	Grey Pine	691	2%
PP	Ponderosa Pine	4,336	10%
Subtotal Conifer Forest/Woodland		**25,141**	**60%**
Hardwood Forest/Woodland Category:			
QC	Canyon Live Oak	4,328	10%
QK	Black Oak	8,117	19%
Subtotal Hardwood Forest/Woodland		**12,445**	**30%**
Shrubs and Chaparral Category:			
CJ	Brewer Oak	245	1%
CS	Scrub Oak	133	<1%
CW	Whiteleaf Manzanita	225	1%
CQ	Lower Montane Mixed Chaparral	3,390	8%
CX	Upper Montane Mixed Chaparral	29	<1%
Subtotal Shrubs and Chaparral		**4,022**	**10%**
Herbaceous Category:			
HG	Annual Grasses and Forbs	13	<1%
Subtotal Herbaceous		**13**	**<1%**
Non-vegetated/other Category:			
BA	Barren/Rock	71	<1%
W3	Reservoir	145	<1%
Subtotal Non-vegetated/other		**229**	**<1%**
Total acres, all CalVeg Alliances		**41,836**	**100%**

< = less than

Forest Stand Conditions

Currently most of the project area consists of dense, relatively homogeneous forested stands of medium- and small-sized trees, with between 60 and 100 percent canopy cover. Live understory vegetation is sparse to nonexistent in these dense stands because most of the site resources are being utilized by the overstory and because little sunlight reaches the forest floor. Dead standing and fallen small trees and shrub "skeletons" are commonly found in these stands. These are the remnants of understory that died out because of increasing shade and resource competition from overstory trees. In contrast, less than two percent of forested stands are open-canopied and can support a substantial understory vegetation layer.

Most forest stands are considered to be mid-seral based on average tree size, age and lack of structural differentiation. In this context, the term “seral stage” refers to a forested vegetation stage of development. Forest vegetation seral stage was assigned considering average overstory tree diameter, species developmental characteristics and time since last notable stand altering disturbance. While there are similarities, “seral stage” in this context is not analogous to the wildlife habitat seral classifications which have further habitat criteria and definitions. See the section on Wildlife in this chapter for a further description.

Table 3-9 below displays the current distribution of canopy cover classes and vegetation seral stages on NFS lands across the project area.

Table 3-9. Distribution of Canopy Cover Class and Vegetation Seral Stage of forested vegetation in NFS lands in the project area.

Canopy Cover Class	Vegetation Seral Stage	Forested Acres*	Percent of Forested Acres
Dense	early	1,481	4.0%
	mid	28,367	76.0%
	late	5,337	14.0%
Closed	early	247	<1%
	mid	1,168	3.0%
	late	377	1.0%
Open	early	230	<1%
	mid	215	<1%
	late	165	<1%
Forested Total Acres		**37,586**	**100.0%**

*Forested acres exclude shrub/herbaceous vegetation, non-vegetated lands and other ownership lands within the project area.

< = less than

Figure 3-3 below displays photographs of typical current conditions found in the main vegetation alliances within the project area. Note the lack of understory vegetation in the Douglas-fir - pine

stand (top left picture) and skeletons of shrubs that have died out of the understory in the black oak stand (bottom picture). Shrubs are growing on the outer edge of the ponderosa pine stand (top right picture) but are absent underneath the canopy of the stand.

Figure 3-3. Examples of typical DP, PP and QK alliance stands (clockwise from top left)

According to historical accounts, most of the larger overstory conifer trees were removed from the project area during settlement and mining operations through the early 1900s (USDA Forest Service 2010). Forest records indicate that there has been no logging in the project area since that time. In the absence of natural fire disturbance or timber harvest, dense vegetation has developed and persisted over time which causes overstory tree growth to slow due to inter-tree competition for resources.

While species diversity is evident within the project area, there is little diversity in tree size or stand structure within individual stands and across the landscape. Non-forest vegetation types – including shrubs and herbaceous vegetation – are noticeably lacking in the project area and are at levels considerably lower than would be expected under pre-settlement natural fire regimes.

Table 3-10 below displays forest vegetation seral stage, canopy cover class and tree size class distribution on NFS lands within the project area. One thing of note in the table below is the seeming paradox of small diameter sized stands classified as late seral vegetation. This is a reflection of mixed oak woodland vegetation types that do not reach the larger average diameters that conifer stands typically do at a late seral stage of development. In the Green-Horse project area small sized late seral stands reflect oak woodland stands that have grown undisturbed for a century or more and are not considered mid-seral.

Tree size class designations are described as follows:

- **Large** - Overstory quadratic mean diameter of 30-inch DBH (diameter at breast height) or larger
- **Medium** - Overstory quadratic mean diameter between 20 – 29 inch DBH
- **Small** - Overstory quadratic mean diameter between 10 – 19 inch DBH
- **Pole-sized** - Overstory quadratic mean diameter between 5-9 inch DBH
- **Sapling** - Overstory quadratic mean diameter between 1 – 4 inch DBH

Table 3-10. Current seral stage, canopy cover class and tree size class distribution (in acres) in forested vegetation types within the Green-Horse project area

		Tree Size Class				
Vegetation Seral Stage	**Canopy Cover Class**	Large	Medium	Small	Pole-Sized	Sapling
Late Seral	Dense	822	664	3,851		
	Closed	1	156	219		
	Open		141	24		
Mid Seral	Dense		15,736	9,562	3,069	
	Closed		342	635	191	
	Open		37	125	53	
Early Seral	Dense				1,144	337
	Closed				178	69
	Open			102	69	58

	Tree Size Class				
Forested Total Acres	**824**	**17,076**	**14,519**	**4,703**	**464**

Certain similarities can be observed between the described vegetation conditions and departure from historic fire return intervals. For example, most (approximately 90 percent) of the forest vegetation has dense canopy cover, and about this same amount of the project area has not experienced fire for 60 years or more (see the wildfire and fuels discussion above). The predominance of small- and medium-sized trees further reflects the lack of forest structure differentiation that occurs under dense, stagnant growth conditions. Table 3-11 displays vegetation seral stage and canopy cover class of stands and the associated time since last fire.

Table 3-11. Time since last fire event in the project area, by seral stage and canopy cover class (in acres)*

		Time Since Last Fire Event		
Vegetation Seral Stage	**Canopy Cover Class**	<20 Years	61-88 Years	>100 Years
Late Seral	Dense	76	522	4,739
	Closed	21	76	281
	Open	5	78	82
Mid Seral	Dense	2,267	9,856	16,244
	Closed	221	592	355
	Open	9	124	82
Early Seral	Dense	168	888	425
	Closed	39	127	80
	Open	13	126	91
Forested Acres Subtotal		**2,819**	**12,389**	**22,378**
Shrub / Herbaceous		570	2,048	1,417
Total Acres		**3,389**	**14,437**	**23,795**

* Total acres exclude non-forested lands and non-federal lands within the project area.
< = less than; > = greater than

Environmental Consequences

Analysis of alternatives was based on the following description of Unchanged, Low, Moderate and High vegetation fire severity effects:

High Fire Vegetation Severity Effects

Where forested stands experience high levels of overstory mortality, the result would be a radical change from dense late- and mid-seral conditions to stands of dead snags with scattered pockets

of residual vegetation. The extent and rate of conifer reforestation would depend on distance to the nearest seed-bearing trees, timing and abundance of seed crops, and competition from more quickly establishing shrub and herbaceous vegetation.

Where oaks such as California black oak (*Quercus kelloggii*) and canyon live oak (*Quercus chrysolepis*) occur, basal sprouts would develop at the base of the burned tree boles if sufficient live tissue survives fire. These species would be the earliest trees to re-establish.

Shrub species that are capable of sprouting, such as manzanita (*Arctostaphylos* spp.) and various oaks (*Quercus* spp.) would be the first to reestablish after high-severity fire. Other vegetation would regenerate from seeds that survived in the soil as well as seeds that are disseminated by wind or by birds and other wildlife. Major changes to overall species composition of shrub communities would not be expected to occur following a high severity fire.

Moderate Fire Vegetation Severity Effects

Moderate fire vegetation severity effects are characterized by noticeable mortality of the predominant vegetation; overstory structure would remain intact but would measurably decrease and would be interspersed with varying sized patches of overstory mortality ranging from small groups of individual trees to up to several acres of complete mortality.

Existing understory vegetation in these stands would most likely be consumed by fire. Growth of understory vegetation after the fire would follow similar patterns as those described above under high severity fire with some exceptions. Because more overstory would be left intact, there would be a higher level and closer proximity of tree seed source, supporting a quicker establishment of tree regeneration. Where most of the overstory remains intact and canopy cover is near or above 40 percent, growth or establishment of understory vegetation would not be as quick as under a high fire severity scenario.

Low Fire Vegetation Severity Effects

In areas that experience a low level of fire severity effects, consumption of surface and understory fuels would occur, but with very little change to the overstory. In areas of both low and moderate vegetation effects, fire would increase stand heterogeneity by creating patches of overstory mortality ranging from a few trees to several acres in size as well as patchy variable mortality in the understory where it exists.

Unchanged

Vegetation communities that are unchanged by wildfire would remain intact with no changes to species composition or stand structure.

Alternative 1 - No Action

Direct and Indirect Effects

In the absence of management or natural disturbance (such as fire), vegetation communities would continue to grow as resources and growing space permit. In forested stands, little light would reach the forest floor and there would generally be very little understory vegetation. Skeletons of dead understory brush and small trees may be found where these have been shaded out as the overstory canopy continues to close.

In brush-dominated vegetation communities, an essentially single layer of dense brush would form a nearly continuous cover. Occasional individual or small groups of trees – typically

California black oak or grey pine – may grow in the brush, but trees would comprise a minor component within brush vegetation types. Without disturbance, dense brush fields would grow increasingly decadent over time and become interspersed with skeletons of dead brush that have been outcompeted by neighboring brush.

Such conditions do not persist in nature in the long term. In forested stands, when trees are crowded and stressed for resources they are increasingly susceptible to drought-related mortality and attacks from insects and diseases. Following drought or insect and disease outbreaks, large expanses of tree mortality ranging from tens to hundreds of acres or more could occur in dense forest conditions.

In brush type vegetation communities, such as lower montane mixed chaparral, densification would lead to increased decadence, as observed by a preponderance of older woody growth with interspersed dead branches, very little new growth and accumulations of dead leaves and twigs on the ground. Brush communities would persist in this condition – creating an increasing accumulation of dead leaves, branches and brush skeletons interspersed with live growth – until a fire occurs.

In the absence of fire, surface fuels would continue to accumulate from dead understory vegetation, dead leaves and needles, dead branches and fallen snags. These accumulated surface fuels, combined with dense live overstory vegetation would create conditions that can fuel undesirable high-intensity fire, with resulting high levels of mortality and broad scale change in vegetation.

In the absence of frequent natural fire due to Forest suppression policies and with implementation of the No Action alternative, fuel loadings and stand densities in the project area would remain high and would continue to accumulate over time barring outside disturbance events.

Cumulative Effects

The indirect consequences of no action as described above, when combined with ongoing management activities (i.e. fire suppression), are predicted to have long-term effects to vegetation in the event of a future wildfire in the project area.

Alternative 2 – Proposed Action (Revised)

Direct and Indirect Effects

Projected vegetation effects from prescribed fire proposed under this alternative are displayed in table 3-12 below. A further discussion of the direct and indirect effects of prescribed fire common to both Alternatives 2 and 3 is presented in Effects Common to Alternatives 2 and 3 below.

Implementation of prescribed fire as proposed would reduce surface and ladder fuels while not markedly changing the dominant overstory in most areas. This reduction of fuel loading would moderate future wildfire behavior for a period of time following prescribed burning.

As discussed earlier, the effectiveness of prescribed fire in reducing fuels would be expected to last for approximately 10-20 years, analogous to one historic fire return interval common in much of the project area. Table 3-13 below displays the predicted effects to vegetation from a wildfire occurring after prescribed fire has occurred and reduced fuel loadings.

Of note is the high proportion of brush vegetation communities projecting to burn at high severity in a wildfire even after prescribed fire has occurred. This may reflect a limitation of the modeling indicating that the model is not sensitive to changes in brush vegetation types due to low intensity prescribed fire that would ameliorate subsequent wildfire effects. It is possible that moderate fire effects predicted by prescribed fire (e.g. creating some dead fuels but leaving much of the brush intact) would create conditions that generally support high intensity fire in a subsequent wildfire. Brush vegetation types are often prone to burn at higher severity than forest stands because of their structure and fuels arrangement. Fire and fuel modeling has inherent limitations, however they are a useful tool to compare affects across different scenarios and treatments. Modeling results indicate a slight decrease in high fire effects to brush vegetation communities under Alternative 2 compared to the No Action Alternative.

Table 3-12. Projected fire effects to vegetation from prescribed fire under Alternative 2, in acres

		Vegetation Fire Effects Alternative 2 – Prescribed Fire			
Vegetation Seral Stage	**Canopy Cover Class**	**High**	**Moderate**	**Low**	**Unchanged**
Late Seral	Dense	2	2	2,310	3,023
	Closed	0	2	143	232
	Open	0	1	22	143
Mid Seral	Dense	45	79	10,754	17,489
	Closed	41	29	527	572
	Open	8	19	68	120
Early Seral	Dense	67	163	552	699
	Closed	24	26	52	144
	Open	12	27	35	155
Forested Acres Subtotal		**199**	**348**	**14,463**	**22,576**
Shrub / Herbaceous		17	3,290	11	718
Total Acres		**216**	**3,638**	**14,474**	**23,509**

Table 3-13. Projected fire effects to vegetation from wildfire under 90th percentile weather after implementation of Alternative 2, in acres

		Vegetation Fire Effects Alternative 2 – Wildfire after Implementation			
Vegetation Seral Stage	**Canopy Cover Class**	**High**	**Moderate**	**Low**	**Unchanged**
Late Seral	Dense	236	53	1196	3,852
	Closed	58	36	73	210
	Open	49	12	76	28
Mid Seral	Dense	511	113	5180	22,562
	Closed	153	55	231	728
	Open	35	15	72	93
Early Seral	Dense	306	61	346	768
	Closed	83	12	88	63
	Open	73	15	85	56
Forested Acres Subtotal		**1,506**	**373**	**7,347**	**28,360**
Shrub / Herbaceous		3273	154	230	378
Total Acres		**4,779**	**527**	**7,577**	**28,738**

Alternative 3 – No Forest Plan Amendment

Direct and Indirect Effects

Under this alternative fuel treatments would only be conducted on 13, 275 acres. The remainder of the project area would be untreated and the vegetation and fuel loadings would be unchanged, reflecting the conditions described under the No Action Alternative . The effects of prescribed fire to vegetation on the 13, 275 acres treated are displayed in table 3-14 below. As described for Alternative 2, implementation of prescribed fire would reduce surface and ladder fuels while not markedly changing the dominant overstory in most treatment areas. See the direct and indirect effects discussion under Alternative 2 for further discussion. The reduction of fuel loading would moderate future wildfire behavior in the treated areas for a period of time following prescribed burning. The effectiveness of the treatments would be expected to last for approximately 10-20 years, analogous to one historic fire return interval typical to most of the project area.

Table 3-15 below displays effects to vegetation projected from wildfire after prescribed fire has occurred on 13,275 acres and where no treatment occurred on the remainder of the project area. Direct and indirect effects are further discussed in the section on Effects Common to Alternatives 2 and 3.

Table 3-14. Projected fire effects to vegetation from prescribed fire under Alternative 3, in acres

		Vegetation Fire Effects Alternative 3 – Prescribed Fire			
Vegetation Seral Stage	**Canopy Cover Class**	**High**	**Moderate**	**Low**	**Unchanged**
Late Seral	Dense	1	1	1,189	1,914
	Closed	0	8	26	106
	Open	0	1	3	32
Mid Seral	Dense	11	18	2,485	6,433
	Closed	9	5	32	61
	Open	2	3	1	10
Early Seral	Dense	15	45	49	65
	Closed	0	1	2	26
	Open	1	1	1	18
Forested Acres Subtotal		**39**	**73**	**3,788**	**8,665**
Shrub / Herbaceous		5	480	0	225
Total Acres		**44**	**553**	**3,788**	**8,890**

Table 3-15. Projected fire effects to vegetation from wildfire under 90th percentile weather after implementation of Alternative 3, in acres

		Vegetation Fire Effects Alternative 3 – Wildfire after implementation			
Vegetation Seral Stage	**Canopy Cover Class**	**High**	**Moderate**	**Low**	**Unchanged**
Late Seral	Dense	1,678	10	1,245	2,403
	Closed	201	4	66	106
	Open	129	2	26	9
Mid Seral	Dense	12,826	326	7,649	7,566
	Closed	842	20	235	71
	Open	148	6	48	13
Early Seral	Dense	969	64	390	58
	Closed	180	25	32	10
	Open	167	34	15	14
Forested Acres subtotal		**17,140**	**490**	**9,706**	**10,250**
Shrub / Herbaceous		3,776	152	13	94
Total Acres		**20,916**	**642**	**9,719**	**10,344**

Wildfire effects to vegetation in areas not treated by prescribed fire would be essentially the same as the effects of the no action alternative. Approximately half of the landscape is projected to experience at to near total loss of overstory vegetation in a wildfire scenario under Alternative 3, resulting in large scale direct loss of vegetative communities. These fuel conditions and projected effects to vegetation from wildfire would not achieve the desired conditions for much of the project area under Alternative 3.

Effects Common to Alternatives 2 and 3

Direct and Indirect Effects

Under both action alternatives, in areas where fire effects to vegetation are high during prescribed burning or during a subsequent wildfire, there would be a high to near total loss of vegetation. What is most strikingly different between these alternatives is the amount and extent of area projected to experience stand replacing fire.

Where there are large expanses of high severity fire, coniferous forest stands can take several to numerous decades to reestablish and develop. This stems in part due to the distance to a seed source, conifer seed motility (the distance that seeds disperse) and seed crop frequency combined with competition by fast sprouting and frequent fast seeding (high motility) grasses, forbs and shrubs. Under these conditions large expanses of brush fields can become established and persist for many decades.

In contrast, in forests where there is mixed or low severity fire with patches or pockets of heavy mortality, there is a ready nearby seed source for tree regeneration as well as newly available growing space. Sprouting and fast seeding understory vegetation is generally quick to establish however conifers are often quick to seed in as well because seed trees are nearby. While overall forest structure may become more patchy as these small openings grow in and more are created by subsequent fires, forest stands remain relatively intact and often larger thick barked trees favorably survive compared to smaller thinner barked trees that are lower growing. Under prescribed fire, approximately one percent of the treated conifer vegetation would experience high fire effects under Alternatives 2 and 3.

Where implemented, prescribed fire would increase stand structure under both action alternatives. This would occur through the creation of small openings resulting from patches of overstory mortality and by variations in stand density and understory cover caused by the removal (mortality) of understory trees and shrubs as well as occasional individual mid-story and overstory trees. Structural heterogeneity would also increase in areas of moderate to low fire effects, but would not measurably increase where vegetation is unchanged by fire effects.

Research has shown that implementing prescribed fire alone, without any thinning or removal of canopy fuels, causes little change to the live stand structure in terms of basal area and tree density; rather, it increases small snags and reduces woody (dead) fuels (McIver et al. 2012). The projected effects to vegetation from prescribed fire bears out this relationship in Alternatives 2 and 3, with the most notable difference being the lesser amount of area treated under Alternative 3. Low to no notable effects to forest overstory vegetation are projected for nearly all of the treated areas (99 percent) in Alternatives 2 and 3.

While prescribed fire alone would not appreciably reduce overall stand density and basal area, it would reduce surface and ladder fuels and consume occasional overstory trees. A minor component of patchiness would be introduced where overstory mortality occurs or where dense understory trees are killed. Where patches of moderate- to high-intensity prescribed fire occur in stands dominated by California black oak, such as in Devils Rock-Hosselkus Research Natural Area (RNA), the fire would remove potential competing seedling to sapling size conifers.

Where the effects of alternatives two and three markedly diverge is when wildfire is projected under 90th percentile weather conditions after fuels reduction treatments by prescribed burning. Whereas alternative three would treat approximately 13,275 acres, wildfire is projected to occur over the entire project area where there is flammable vegetation or over approximately 41,621 acres.

Under Alternative 2, after prescribed burning, high fire effects (i.e. stand replacement) from a wildfire are projected to occur over 1,506 acres of forest vegetation or roughly 4 percent of the forest vegetation within the project area. In contrast, under Alternative 3, high fire effects from a wildfire are projected to occur over 17,140 acres of forest vegetation – nearly half of all forest vegetation - within the project area. This is because much of the project area would not be treated by prescribed fire under Alternative 3 and these areas are projected to burn in a wildfire as they do under the No Action Alternative.

Conclusion

Perhaps the greatest benefit of fuel treatments that remove surface and ladder fuels is that they can significantly reduce subsequent wildfire severity and overstory tree mortality (Safford et al. 2012). After prescribed fire, wildfire effects to vegetation would be substantially reduced. It

should also be noted that under Alternative 2, much of the projected high level of effects to vegetation would occur in shrub/herbaceous vegetation rather than in forested stands. Under Alternative 2, the patterns of effects to vegetation from wildfire after prescribed burning would be similar to those from prescribed burning. The trend would be toward a high fire frequency and low fire intensity that more closely approximates historical conditions.

Prescribed fire would not appreciably reduce forest stand density and basal area in most instances, and other mortality risks associated with high stand density would still remain. These include density-related mortality risks from drought, disease and insect attacks. Research has found, however, that prescribed fire can directly reduce dwarf mistletoe infections in forest stands and may thereby slow the spread of mistletoe disease (Conklin and Armstrong 2001). Areas of heavy mistletoe infection have not been noted in the project area but could potentially exist. Where dwarf mistletoe occurs, prescribed fire could help control the levels of infection and spread.

Prescribed fire would achieve the desired reduced future fire behavior and conditions that would allow fire to resume a more natural role in ecosystem processes. Stand density at the project scale would remain high, as would risks of density-related mortality from drought, insect outbreaks and disease. Alternative 2 addresses the immediate concerns of large scale vegetation and habitat loss from wildfire while providing an incremental increase in stand heterogeneity and some potential disease control. Alternative 2 also helps create conditions that could support subsequent frequent low- to moderate-severity fire more similar to the natural ecological processes associated with these vegetation types.

Alternative 3 would treat about one-third of the project area, and while future wildfire effects to vegetation are predicted to be similar in the treated areas to Alternative 2, those effects would be similar to No Action over most of the project area, which would remain untreated. High to moderate effects to overstory vegetation from wildfire would be less than under the No Action Alternative; however, the result on a landscape scale, as under No Action, would be a widespread change from predominantly dense forested vegetation to large open expanses of snags with a developing understory of sprouting shrubs, hardwoods and herbaceous vegetation. Large expanses of standing snags would fall over time and persist as heavy fuel loadings that could support subsequent high severity fire.

Cumulative Effects

Ongoing and/or future activities which may influence vegetation in the project area are described in Appendix A and include fire suppression activities, ongoing recreational activities, the Bear Hazardous Fuel Reduction Project, the raising of Shasta Dam by the Bureau of Reclamation, and an invasive weed treatment at Packer's Bay. The raising of Shasta dam would inundate of 18.5 feet of shoreline comprised of a variety vegetation types that would be removed from the landscape when the lake is at full pool. Fuel reduction projects may add to the benefits derived from the treatments of either action alternative by contributing to the reduction in fuel loading. Packer's Bay Invasive species removal project involves the removal of invasive plants on a relatively small portion of the project area.

Alternatives 2 and 3 would reduce the risk of high-severity fire resulting from the cumulative effects of a previous history of fire suppression, a buildup of ground and ladder fuels in the treatment units, and the potential for fire ignitions from the ongoing recreational (boating, hiking, camping) activities in the areas treated. When combined with past and other current and foreseeable projects, the collective benefit of reducing fire hazard across a broad landscape can

be realized. Past wildfires (e.g. Bear Fire, Jones Fire, and Stein Fire) have influenced the vegetation within the project area due to high fire vegetation severity effects causing stand type conversion, loss of overstory and development of undesirable heavy fuel concentrations in the fire affected areas. None of the potential future or ongoing actions will have additive impacts to the proposed alternatives and are unlikely to influence the outcome of either action alternative.

Invasive Plants

Invasive and noxious weeds have the potential to threaten ecosystem integrity and degrade wildlife habitat by displacing and competitively excluding native species from local plant communities. The Northern Province Noxious and Invasive Weeds Program Strategy (USDA Forest Service 2001) identifies laws, policy and management direction for land managers at the Shasta-Trinity National Forest. Current management direction for management of noxious weeds is given in FS Manual 2905 (USDA Forest Service 2011a). The Shasta-Trinity Forest Plan also provides direction for managing noxious weeds. The Forest Plan directs the Forest to ensure that "the spread of weed plant populations has been arrested and native plants are being reintroduced where suitable (USDA Forest Service 1995a).

The cumulative effects analysis considers the project area as the furthest extent of effects for all alternatives. The time period for analysis of cumulative effects is 20 years from completion of project activities or, in the event of selection of the No Action Alternative, 20 years from the date of the decision. This time period reflects the approximate duration of the effectiveness of the proposed treatments in reducing future fire behavior.[16]

Affected Environment

In addition to the physical environment, climate and overstory vegetation described elsewhere in this document, the project area contains approximately 56.6 miles of road, 33.4 miles of trail, and an unknown amount of previously constructed dozer fireline where noxious weeds may proliferate but are not currently documented. Watercourses such as streams are also documented pathways in which invasive plants may spread (Gregory et al. 1991, Parendes and Jones 2001), and there are approximately 589 stream miles within the project area. In general, though, the project area has limited road miles compared to that of other portions of the Forest. Off-road and off-trail areas that are used by recreationists such as boaters, hunters, or gold-panners may also have small weed populations due to introduction by human vectors (Pickering and Mount 2010).

The most abundant weed species documented in the project area include *Centaurea solstitialis* (yellow star thistle), *Hypericum perforatum* (St. John's wort), and *Rubus armeniacus* (Himalayan blackberry); however, other noxious weed species do occur.

Noxious Weed Species in the Project Area[17]

California Department of Food and Agriculture (CDFA) and California Invasive Plant Council (Cal-IPC) have ranked weed species in order of priority for management (Cal-IPC 2006, CDFA 2011). In addition to CDFA and Cal-IPC ranking systems, the Shasta-Trinity National Forest a identifies high priority weed species as those species of important local management concern because of their: 1) currently limited distribution on the Forest, 2) highly invasive nature, and 3) demonstrated potential to displace large geographic areas of native plant communities (USDA

[16] See the project Fire, Fuels, Air Quality, and Vegetation report in the project record
[17] See Hickman 1993, Bossard et al. 2000 and DiTomaso and Healy 2007

Forest Service 2001). High and moderately ranked weeds are given priority in this analysis. Table 3-16 below describes the moderate- or high-priority noxious weeds documented in the Green-Horse project area.

Table 3-16. Moderate- and high-priority weed species in the Green-Horse project area

Species (common name)	Number of Known Occurrences
Ailanthus altissima (tree of heaven)	One roadside occurrence, documented in the project area near the Squaw Creek FS Station
Bromus madritensis ssp. rubens (red brome)	Populations documented in the project area along First and Arbuckle Creeks.
***Centaurea solstitialis* (yellow star thistle)**	Several occurrences documented in the project area along Fender's Ferry Road and Pit 7 roads. There is an elevated concern for this species within the project area.
***Cirsium vulgare* (bull thistle)**	One population documented in the project area north of Smith Creek.
Hypericum perforatum (St. John's wort)	Occurs throughout the project area.
Rubus armeniacus = Rubus discolor (Himalayan blackberry)	Occurs throughout the project area. One infestation of *R. armeniacus* is encroaching on a Forest Sensitive species population – *Neviusia cliftonii* (Shasta snow wreath) – in the Low Pass Creek area.

In addition, several species that do not have documented occurrences within the project area but are of concern due to their close proximity (within approximately two miles) include:

Cytisus scoparius (Scotch broom)

Genista monspessulana (French broom)

Rubus laciniatus (cut leaved blackberry)

Torilis arvensis (field hedge parsley).

Environmental Consequences

Alternative 1 - No Action

Direct, Indirect and Cumulative Effects

Implementation of the No Action Alternative would have no direct effects on weed spread or suitable invasive plant habitat. Suitable habitat for weeds generally decreases with increased canopy closure. Lack of further disturbance and maintenance of the canopy would continue to inhibit the establishment of weeds, allowing native species to occupy habitat in the project area. Other factors that contribute to introduction and establishment of weeds (e.g., off-road vehicle use, proliferation of existing roadside weeds, recreational use of trails, streams and other sites, and potential wildfires) would continue unabated.

The previously noted high to moderate fire behavior predicted under no action indicates that, under current fuel conditions, moderate to high vegetation severity would be expected to occur over most of the project area, with a subsequent creation of widespread new habitat for invasive plants to either establish or expand their populations. Bulldozer firelines constructed during suppression of future wildfires would also create habitat for invasive plant colonization and spread (Erickson and White 2007).

Effects Common to Alternatives 2 and 3

Direct and Indirect Effects

Prescribed Fire

Prescribed fire may reduce weed species occurrence in the short term by killing or damaging individual plants or populations. The effectiveness of prescribed fire in killing invasive plants would be determined by the season of burning. For example, if prescribed fire were implemented during the flowering season of these species, there would be a greater likelihood of sufficient damage to or consumption of the critical plant tissues to kill the plants. Although the abundance of these species would be temporarily reduced following prescribed fire, this would likely be a short-term benefit.

Noxious weeds have developed strategies that allow them to out-compete native species by germinating and occupying terrain faster than native species and also by persisting under environmental conditions that native species may not tolerate as well. Noxious weeds are often disturbance followers (Bossard et al. 2000). Indirect impacts conducive to weed introduction and spread include the opening of the overstory canopy, which would allow for increased light penetration to understory vegetation. Some data suggest that invasive species are more abundant in conifer forests where the canopy is "broken"; however, this is more of a concern for grass species such as cheat grass than for herbaceous invasive plants (Klinger et al. 2006, Keeley 2006).

The risk of introduction of new noxious weed species in the project area would be reduced – but not eliminated – through project design features WEED-1 through WEED-4 (see Chapter 2). Because active and passive crown fire would occur on a small percentage of the project area under both action alternatives (see the Wildfire and Fuels discussion above), overstory canopy removal would likely only occur in small, scattered patches. Surface fire would not open the overstory canopy; however, it would remove surrounding vegetation and duff, which would decrease competition for resources and possibly allow noxious weeds to thrive (Zouhar et al. 2008). These newly available resources, however, may also be utilized by native species.

Studies have shown that when overall overstory tree density remains high – as with implementation of either action alternative – disturbances such as low-severity prescribed fire have little impact on plant community production or composition (Sabo et al. 2009). With the low amount of predicted passive and active crown fire, the small number of documented weed occurrences in the project area, and the implementation of project design features described in Chapter 2, prescribed fire under either action alternative would result in a minor short-term risk of weed infestation.

Fire season may also play a major role in the success of noxious weed invasions. For example, reduced native recovery has been reported for "out-of-season" prescribed fires, and this void in native cover is often filled with weed species (Keeley et al. 2011). The mechanism for this phenomenon is commonly attributed to prescribed burns taking place during winter or spring when vegetation and soil moistures are higher than other times. These burns may cause lethal heating of seed banks from moist heat. Winter burning also greatly decreases – by up to five months – the length of the first growing season, which could limit survival during the ensuing dry summer (Keeley et al. 2011).

Ailanthus altissima, Bromus madritensis ssp. *rubens* and *Cirsium vulgare* have been shown in various studies to increase in density and abundance following prescribed burns (Bossard et al.

2000, Simonin 2001, Zouhar 2002, Fryer 2010). Accounts in the literature of *Hypericum perforatum* response to fire are inconclusive and varied. Study results ranged from no response to immediate increases in cover and/or density and immediate decreases in cover and/or density, followed by increases several years post-fire (Zouhar 2004). *Rubus armeniacus* populations spread after the application of a low-intensity prescribed burn in a wetland prairie in Oregon (Pendergrass et al. 1998). No such wetland habitat occurs in the project area, however.

As previously noted, prescribed burning may reduce noxious weed abundance; however, this effect is likely to be short-term and minor. For example, studies have shown a reduction of *C. solstitialis* and *R. armeniacus* after the application of prescribed fire (Dennehy et al. 2011). However, this was dependent on the timing of the application (e.g. early July, after senescence of grass and broadleaf species but before *C. solstitialis* produced seed) and also the continuity or repetition of the application (Kyser and DiTomaso 2002). With regard to broom species, prescribed fire did show the successful reduction of the seed bank – and therefore the occurrence of – *Genista monospessulana* (Alexander and D'Antonio 2003); however, this was in a grassland ecosystem with repeated prescribed fire treatments.

In general, low-intensity surface fire (as is predicted for the both action alternatives) would not be expected to produce the highly-disturbed, open-canopy or edge environments that many invasive plant species require for colonization or spread. Pre-burn species composition also plays an important role in determining the relative effects of fire on native vs. nonnative species (Keeley et al. 2011) and, as there are not a large number of documented noxious weeds populations within the analysis area, any increase in these species would be predicted to be minor.

Hand Thinning, Hand Piling and Pile Burning

There are no documented weed occurrences within the proposed hand thin, pile, and pile burn treatment areas. One occurrence of *Cirsium vulgare* is documented within 300 feet of this treatment type. One study (Bradley et al. 2006) in the nearby Whiskeytown Recreation area found that *C. vulgare* populations were heavier in hand-thinned plots than control plots. Because these treatments border private lands and no field surveys were conducted on private holdings, it is unknown how many noxious weed occurrences may be within close (0.25 mile) proximity to this treatment type.

Burn piles may create suitable habitat for noxious weeds (Keeley 2006); however, the limited extent of this proposed treatment (less than one percent of either action alternative) would render this effect minor.

Cumulative Effects

Past actions such as wildfires and associated fire suppression tactics (e.g. fireline construction), the creation of fuelbreaks (e.g. the Gilman Shaded Fuelbreak project) or other vegetation/fuels management projects (e.g. Green Mountain, Northwoods Vegetation Management) have caused some ground-disturbance and the removal of topsoil, and thus created suitable habitat for invasive species within the analysis area. The Bear Hazardous Fuels Reduction project may have also increased or spread some weed populations due to habitat alteration or an increase in non-project vectors (e.g. recreationists) (Posey 2006). Past wildfires may also have directly killed some noxious weed individuals; however, it has been observed that certain species, such as *Centaurea solstitialis*, significantly increased after the Jones and Bear fires (Posey 2006).

Current or ongoing actions that may impact noxious weed populations include fire suppression activities, road and trail maintenance (e.g. removal of brush or logs) and timber harvest on private lands. Dispersed camping, hiking, biking and other recreational activities that have, are, or will continue to occur in the area also create vectors for weed dispersal (Pickering and Mount 2010).

Future actions have documented weed infestations within their project boundaries (e.g., the I-5 Corridor Fuels Reduction Project, which has identified 30 nonnative plant species "having the potential to do ecological harm" [Boes 2012 personal communication]), and these infestations may increase due to implementation of these projects. Design features for the I-5 Project, however, would mitigate this impact to some extent. The raising of Shasta dam would inundate some known weed occurrences (e.g. *Ailanthus altissima, Centaurea solstitialis, Cirsium vulgare, Cytisus scoparius, Genista monospessulana, Rubus armeniacus, Spartium junceum, Verbascum thapsus*). However, it may simply temporarily displace these occurrences while still allowing for re-establishment along the new shoreline in the long term.

The reasonably foreseeable Packer's Bay Invasive Species Removal Project is located approximately two miles west of the Green-Horse project area. This project may have negligible short-term adverse impacts to native vegetation affected by the use of herbicide; however, herbicide application would be limited to the cut stumps of the broom plants and would be conducted by trained/certified applicators (USDA Forest Service 2009c). There would also be long-term moderate beneficial impacts to native vegetation from that project, in particular to one occurrence of *Neviusia cliftonii* – a Forest Service Sensitive species – from the reduction of invasive brooms (*Cytisus scoparius*, *Genista monspessulana*, and *Spartium junceum*).

Regardless of current weed treatments on the Shasta-Trinity National Forest as a whole, however, noxious weed introduction and spread is a constant, recurring issue. Both action alternatives would reduce the risk of future widespread disturbance of overstory canopy and surface vegetation from high intensity wildfire, thereby reducing the risk of future noxious weed establishment and spread in the areas treated.

Alternative 2 – Proposed Action (Revised)

This alternative would treat 41,836 acres, which would cause more overall vegetation disturbance from hand thinning, hand piling and pile burning as well as from prescribed fire than under Alternative 3.

Alternative 2 includes approximately four acres of dozer fireline construction or reconstruction to facilitate implementation of prescribed fire. It is well established that dozer firelines may have weed infestations that can persist for years (Merriam et al. 2006, Keeley 2006). The creation of a bare soil substrate could 1) increase erosion and soil loss, thus destabilizing native plant habitat; and 2) increase solar radiation to the soil (thus drying it out) via the removal of litter and duff. These impacts to native vegetation would, therefore, increase the available habitat for noxious weeds and reduce competition from native species. Increased vehicle traffic during project implementation would also increase the risk of weed introduction and spread. Although no noxious weed occurrences are documented within these areas, some invasive plant occurrences may have gone undetected during field surveys.

Project design features for noxious weeds described in Chapter 2 would reduce – but would not eliminate – the risk of weed introduction and spread in these areas. Dozer line construction or

reconstruction – when combined with past, current and foreseeable actions (see Appendix A) – would likely cause a short-term negligible increase in the risk of noxious weed invasion.

Alternative 3 – No Forest Plan Amendment

This alternative would treat 13,275 acres, which would cause less overall vegetation disturbance from hand thinning, hand piling and pile burning as well as from prescribed burning than Alternative 2. However, when combined with ongoing fire suppression, cumulative effects with regard to future widespread high-severity fire – and the resulting creation of large expanses of available habitat for invasive species – would be similar to Alternative 1 (no action) in the majority of the project area, which would remain untreated.

Special Status Botanical Species

The cumulative effects analysis considers the project area as the extent of alternatives effects modeling for all botanical species noted in this report with the exception of *Neviusia cliftonii* (Shasta snow-wreath). For *Neviusia cliftonii*, the cumulative effects analysis considers all acreage within a five-mile buffer around the project area (approximately 248,000 acres), as this is the extent of all known occurrences of this species.

The time period for measurement of cumulative effects is 20 years from the completion of project activities or, in the event no action alternative is selected, 20 years from the date of the decision. The 20-year time period reflects the estimated duration of the effectiveness of the proposed fuels treatments.[18]

It should be noted that the potential suitable habitat for botanical species quantified for this project is likely highly overestimated as 1) the most inclusive query was chosen for each species; 2) several of the species addressed are habitat generalists to some degree; and 3) GIS layers are frequently at too coarse a scale (i.e. lacking in microsite information) to produce narrower, detailed habitat models.

Affected Environment

Federally Listed Threatened, Endangered and Proposed Species

Online queries of the US Fish and Wildlife Service Endangered Species website indicate that no federally listed Endangered or Threatened plants or plant species proposed for federal listing are known to occur in the areas proposed for treatment (USDI Fish and Wildlife Service 2011); no such species are known or suspected to occur on the Shasta-Trinity National Forest[19] (USDA Forest Service 2007).

Forest Service Sensitive and Endemic Species

Forest Service Sensitive species are those vascular plant, bryophyte, lichen, and fungi species either eligible for listing under the Endangered Species Act or whose viability is of concern. These are protected by Forest Service regulations and Manual direction. The Region 5 Sensitive Plant List was updated and signed July 3, 2013.

[18] See the project Fire, Fuels, Air Quality, and Vegetation report in the project record

[19] USFWS has declared that one species, whitebark pine (*Pinus albicaulis*) warrants protection under the Endangered Species Act (ESA), but that adding the species to the Federal List of Endangered and Threatened Wildlife and Plants is precluded by the need to address other listing actions of a higher priority.

Forest Service guidelines (USDA Forest Service 2005) are designed to ensure that management activities do not contribute to the loss of viability of any native or desired non-native species, leading to a trend toward the Federal listing of any species under the Endangered Species Act. The Forest Plan has a standard and guideline that requires the analysis of potential effects of all ground disturbing projects on Sensitive and Forest Plan Endemic plants and their habitat and mitigation of project effects to avoid a decline in species viability at the Forest level (Forest Plan, page 4-14).

Based on surveys of portions of the project area and remote sensing data concerning the presence of suitable habitat for target species, the following Forest Service Sensitive vascular plant, bryophyte and fungi species are either known to occur or have suitable habitat within the project area:

Boletus pulcherrimus	red-pored bolete
Clarkia borealis ssp. *borealis*	Northern clarkia – documented in the project area
Cypripedium fasciculatum	Brownie lady's-slipper
Cypripedium montanum	mountain lady's-slipper
Eriastrum tracyi, sometimes included in *E. brandegeeae*	Tracy's eriastrum
Fritillaria eastwoodiae	Butte County fritillary – documented in the project
Lewisia cantelovii	Cantelow's lewisia
Mielichhoferia elongata	elongate copper moss
Neviusia cliftonii	Shasta snow-wreath – documented in the project area
Phaeocollybia olivacea	olive phaeocollybia
Sedum obtusatum ssp. *paradisum*	Canyon Creek stonecrop

Forest Plan Endemic species are rare species confined wholly or mostly to the Shasta-Trinity National Forest. These are afforded the same protection as Sensitive species by direction in the Forest Plan (p. 4-14). Of four Forest Plan Endemic botanical species described in the Forest Plan as known to occur on the Shasta-Trinity National Forest, only *Ageratina shastensis* has known occurrences within the project area.

Botanical Species Characteristics and Habitats

Information for Sensitive botanical species accounts is primarily derived from Hickman 1993, Nakamura and Nelson (2001), Baldwin et al. 2012, CNDDB (2014), NatureServe (2011), CNPS (2014), Region 5 Sensitive Plant Species Evaluation and Documentation Forms (2012 and 2013 – see project file) and personal communication with STNF botanical staff (2010-2014). Global and state ranks are based on the CNDDB standard. For explanations of California Rare Plant Rank (CRPR) 1-4 see http://www.cnps.org/cnps/rareplants/ranking.php.

Ageratina shastensis (Shasta eupatory) is a multi-stemmed perennial herb with a woody caudex that is ranked G2 S2 and CRPR 1B.2. It is limited to the eastern Klamath Mountains in Shasta County and t grows in crevices of limestone or metasedimentary rocky substrates soils in chaparral and lower montane coniferous forest, at elevations from 1,200-5,840 feet. There are 16 documented populations of *A. shastensis* on the Shasta-Trinity National Forest. Twelve of these occurrences were revisited in 2010 resulting in 10 relocations and two new occurrences

(unpublished survey data from North State Resources). A total of 10 documented populations of *A. shastensis* occur within the project area – in the Devil's Rock Hosselkus region and upslope of Curl Creek, on limestone substrate, and in mixed vegetation types (black oak, Douglas-fir– pine, and some canyon live oak) at Gray Rocks, and North Grey Rocks. Approximately 46,075 acres (or 99 percent of the project area) is modeled for potential suitable habitat for *Ageratina shastensis*.

Boletus pulcherrimus (red-pored bolete) is a mycorrhizal fungus that typically grows in mature conifer forest in relatively humid or coastal locations. Populations, if present in the project area, would most likely occur in north-facing riparian areas (mainly adjacent to perennial streams) at elevations below 5,200 feet. This species has both Forest Service Sensitive and Survey and Manage status.

There are two known occurrences on the Forest, both within a mixed conifer vegetation type and within Trinity County. Approximately 26,463 acres (57 percent of the project area) is modeled for potential suitable habitat for *B. pulcherrimus.*

Clarkia borealis ssp. ***borealis*** (northern clarkia) is annual herb ranked as G3T2 S2.3 and CRPR 1B3. It is endemic to northern California, and locations are known only in Shasta and Trinity counties. *Clarkia borealis* ssp. *borealis* prefers somewhat early seral, cismontane (west of Sierra Nevada mountains) and foothill woodlands, chaparral, and lower montane coniferous forest habitats between elevations from 1,300 to 4,400 feet. This species is usually found in openings, including roadsides and logged or burned areas, which may indicate a possible required disturbance regime (Niederer et al. 2014). Additionally, since *C. borealis* ssp. *borealis* occupies early seral habitat and its seeds have no specific mechanism to aid in long-distance dispersal, populations existing as dormant seed banks may be extirpated if suitable early seral habitat is not created within the life span of the dormant seeds (USDA Forest Service 2012). Species in the *Clarkia* genus are early successional taxa that produce small hard-coated seeds that persist in the soil for at least a few years (McCue and Holtsford 1998). Additionally, the number of seeds produced by a *Clarkia* population is many times more than that needed to replace the population, even if a small number of individuals are lost (Nelson 2014 personal communication). There are 72 documented occurrences of this species in CNDDB on the Shasta-Trinity NF.

There are two known occurrences within the project area boundary (one on private land and the other on federal land) and 16 within five miles of the project area. Since many *Clarkia* individuals were not in flower during the time of the surveys, and that *C. borealis* ssp. *borealis* is indistinguishable from the commonly found *C. rhomboidea* until flowering, it is probable that more occurrences exist. Approximately 46,075 acres (or 99 percent of the project area) is modeled for potential suitable habitat for *C. borealis* ssp. *borealis.*

Cypripedium fasciculatum (clustered lady's slipper) is a perennial rhizomatous herb ranked as G4 S3.2 and CRPR 4.2. This species has both FSS and Survey and Manage status. It generally—but not exclusively— occurs in mid-to-late seral Douglas-fir or mixed conifer forests on a variety of soil types and often in association with riparian areas. Several stages in this species life-cycle, particularly early stages of seedling development, depend on associations with mycorhizzal[20] fungi. Thus habitat needs of the fungi must also be met to meet *C. fasciculatum* habitat needs. Additionally, *Cypripedium* species have a tendency to revert to dormancy during their lifecycles making monitoring and accurate accounting of population trends difficult. The

[20] Mycorrhizae are symbiotic associations between a fungus and the roots of a vascular plant

currently known distribution of *C. fasciculatum* is widespread but sporadic throughout the western United States.

There are 45 documented occurrences of this plant on the Shasta-Trinity National Forest – none of which are in Shasta County. Approximately 26,463 acres (or 57 percent of the project area) is modeled for potential suitable habitat for *C. fasciculatum*.

Cypripedium montanum (mountain lady's slipper) is a perennial rhizomatous herb ranked as G4 S4.2 and CRPR 4.2. *Cypripedium montanum* has both FSS and Survey and Manage status. Like *C. fasciculatum*, this species generally occurs in mid-to-late seral mixed conifer forests however it can be found in earlier seral forest as well. It is associated with variety of soil types and sometimes in association with riparian areas at elevations of 1300 to 6000 feet. Several stages in this species life-cycle, particularly early stages of seedling development, depend on associations with mycorrhizal fungi. Thus habitat needs of the fungi must also be met to meet *C. montanum* habitat needs. Additionally, *Cypripedium* species have a tendency to revert to dormancy during their lifecycles making monitoring and accurate accounting of population trends difficult. The currently known distribution of *C. montanum* is widespread but sporadic throughout the western United States.

There are 61 documented occurrences on the Shasta-Trinity National Forest, with only two occurring in Shasta County – the closest approximately14 miles to the east of the project area. Approximately 26,463 acres (or 57 percent of the project area) is modeled for potential suitable habitat for *C. montanum*.

Eriastrum tracyi (sometimes included within ***Eriastrum brandegeeae*)** (Tracy's eriastrum) is an annual herb that is experiencing some ranking updates due to recent taxonomic changes (see following). Currently is it ranked bG3Q S3 and CRPR 3.2. First described in 1945 (Gowan 2008), *Eriastrum tracyi* has been considered a synonym with *E. brandegeeae* from 1993 until recently (Gowan 2008, USDA Forest Service 2012). In northern California it is found on dry, gravelly to loamy soils in annual grassland openings in cismontane woodlands, or chaparral at elevations from 1100 to 5400 feet often along disturbed roadsides. Population sizes range widely for this annual species (i.e. from 15 individuals to over 92,000). Some disturbance which would in the litter, duff and vegetation, may benefit *E. tracyi* by allowing for expression of the seedbank and by creating new habitat for this species. Additionally, the number of seeds produced by an *Eriastrum* population is many times more than that needed to replace the population, even if a small number of individuals are lost.

There are 42 populations of this species documented within Shasta County (private and public lands) – five of which are within the STNF boundary and three that are on N.F. lands. The closest documented population of *E. tracyi* to the project is approximately 30 miles east of the project area on the Lassen National Forest. Approximately 46,075 acres (or 99 percent of the project area) is modeled for potential suitable habitat for *E. tracyi*. No occurrences of this plant were found during field surveys however, due to this plant's diminutive size there is the potential that occurrences were overlooked

Fritillaria eastwoodiae (Butte County fritillary) is a perennial bulbiferous herb ranked as a G3Q S3 and CRPR 3.2 species. This species distribution is limited to the Cascade Range, specifically Tehama, Butte and Shasta Counties. Although Fritillaria eastwoodiae can be found within chaparral and hardwood forests, within the Shasta Lake area it is found primarily in openings in lower montane coniferous forest at elevations from 1,500 to 4,900 feet. Accurate population counts are challenging since, like *Cypripedium* species, some *Fritillaria* individuals may revert

to dormancy or non-flowering condition even after reaching maturity (Nelson 2014 personal communication). Since this species is found in openings, some amount of canopy opening and litter removal activity may be beneficial to this species if it is done when the plants are dormant and the bulb is not disturbed.

There are seven documented occurrences in NRIS on the Forest (22 in CNDDB), five of which occur within the project area. *Fritillaria eastwoodiae* is also thought to potentially hybridize with other species (DeWoody and Hipkins 2012) therefore all occurrence information may not be certain. Approximately 46,075 acres (or 99 percent of the project area) is modeled for potential suitable habitat for *F. eastwoodiae*.

Lewisia cantelovii (Cantelow's lewisia) is a perennial herb ranked as G3 S3and CRPR 1B.2. It is found on moist rock (often metamorphic or granite) outcrops or cliffs, often above streams, or occasionally serpentinite seeps, in hardwood and coniferous forests at elevations from 500 to 3000 feet. Due its perennial nature, it potentially could regenerate after disturbance however its habitat may also indicate that it is a disturbance avoider.

There are seven documented occurrences on the Forest, all in Shasta County, with the closest occurrences to the project area approximately nine miles to the west near Little Dog Creek. Approximately 40,433 acres (or 87 percent of the project area) is modeled for potential suitable habitat for *L. cantelovii*.

Mielichhoferia elongata (elongate copper moss) is a moss ranked as G4 S2 and CRPR 2.2. It occurs in several disjunct sites in Europe, Asia, and North America (Shaw and Schneider 1995). *Mielichhoferia elongata* is found cismontane woodland on metamorphic rock and, in California, usually vernally mesic (i.e., seasonally moist) areas at elevations of 1,640 to 4,265 feet. Additionally, metamorphic, sedimentary, limestone, granite and serpentine rock outcrops that often contain copper or other heavy metals may provide habitat for this species.

There are six known occurrences on the Forest, all within Trinity County mainly along Highway 299. Many populations occur along roadsides and could be impacted from road realignment or Highway expansion projects. Mining could also have impacts to this species. Approximately 46,075 acres (or 99 percent of the project area) is modeled for potential suitable habitat for *M. elongata*; however, its most likely habitat is a much smaller area where the soil substrate consists of copper minerals (e.g., areas along the Bully Hill Mine/Horse Creek).

Neviusia cliftonii (Shasta snow-wreath) is a deciduous, rhizomatous, perennial shrub ranked as G2 S2.2 and CRPR 1B.2 (i.e., rare, threatened, or endangered in CA and elsewhere). *Neviusia cliftonii* is currently found only in the eastern Klamath Mountains in the vicinity of Shasta Lake within cismontane woodlands, lower montane coniferous forest and riparian areas although it can occur in dry substrates as well. Much of the historic extent of the species is thought to have been inundated with the creation of Shasta Lake (USDA Forest Service 2012). This species was previously considered associated with limestone substrates; however, newer information indicates that nearly half the documented occurrences in Shasta County grow on non-limestone substrates (Lindstrand and Nelson 2006) at elevations from 980 to 1,640 feet. Since *Neviusia cliftonii* has rhizomes, it is possible that the vegetative spread of this plant may allow for regeneration after disturbance events.

There are 21 populations of *Neviusia cliftonii* currently documented in CNDDB however at the time of this writing one more recently found (2014) population is being added to the database (Nelson 2014 personal communication). Eighteen populations of *N. cliftonii* occur within the

Forest boundary— and all of which occur within a five-mile radius of the project area. Eight occurrences of *N. cliftonii* are documented within the project area. Approximately 46,075 acres (or 99 percent of the project area) is modeled for potential suitable habitat for *N. cliftonii*.

Phaeocollybia olivacea (olive phaeocollybia) is a mycorrhizal gilled fungus that grows in patches within mixed forests containing oak or pine trees. It is ranked G3 and has no CRPR listing. *Phaeocollybia olivacea* is considered endemic to western United States from central Oregon coast south to Santa Cruz County (Castellano et al. 2003). Its patchy distribution precludes estimation of population size and area of occupancy. All known occurrences of this species on the Forest are within Trinity County (outside the project area).

There are 21 occurrences of *P. olivacea* documented within the STNF NRIS database however all of these occurrences are a minimum of 25 miles outside the Green-Horse project area. Approximately 40,433 acres (or 87 percent of the project area) is modeled for potential suitable habitat for *P. olivacea*.

Sedum obtusatum ssp. ***paradisum = Sedum paradisum*** (Canyon Creek stonecrop) is a perennial herb ranked G4G5T1 S1.3 and CRPR 1B.3. It can be found along rock outcrops (including limestone) in forest or woodland openings at elevations from 2500 to 6100 feet mainly in the southern Klamath Ranges of California. Due its perennial nature, it potentially could regenerate after disturbance however its habitat may also indicate that it is a disturbance avoider

There are 26 documented occurrences in NRIS of *Sedum obtusatum* ssp. *paradisum* on the Forest not including another ten which may also be this taxon, pending current genetic and morphometric study (USDA Forest Service 2012). The nearest occurrence of *S. paradisum* ssp. *paradisum* to the project area is approximately six miles to the north near Bagley Mountain. Approximately 46,075 acres (or 99 percent of the project area) is modeled for potential suitable habitat for *S. obtusatum* ssp. *paradisum*.

Survey and Manage Species

Surveys for species described as Survey and Manage under the Northwest Forest Plan were not performed for this project, as non-commercial fuels treatment such as prescribed burning is indicated as exempt from required survey under the 2006 "Pechman Exemptions."[21]

Specific additional surveys for species described as Survey and Manage under the Northwest Forest Plan were not performed for the proposed project, as non-commercial fuels treatment (i.e. prescribed burning – as in the Green-Horse project) is indicated as exempt from required survey under 'Pechman Exemptions'. Additionally, the requirements of managing known sites for these species are exempt for all prescribed burn areas under the Pechman Exemptions.

There are approximately 4 acres of dozer line/fireline proposed and 206 acres of hand thinning proposed for the Green-Horse project area. There are no known occurrences of Survey and Manage Species along these areas and there is no suitable habitat along these ridgelines or

[21] Four exempted habitat disturbing activities, or projects, are in place from the October 11, 2006 modified injunction order in Northwest Ecosystem Alliance v. Rey (Case 2:04-cv-00844-MJP, Doc. No. 109). The exempted activities relevant to this project, which can proceed and do not require surveys, include:

- Thinning projects in stands less than 80 years old;
- The portions of projects involving hazardous fuel treatments where prescribed fire is applied.

recreation residence area for those species (as identified by both general botanical field surveys and GIS modeling) therefore no effects for these species is discussed further in this document.

Environmental Consequences

Alternative 1 - No Action

If no wildfire occurs in the project area, implementation of no action would have no effects to sensitive and endemic botanical species. However, with implementation of no action, approximately 66 percent of the forested ecosystems and 96 percent of the shrub and herbaceous vegetation communities are predicted to have high levels of mortality if a wildfire occurs. The predicted amounts of active and passive crown fire and the amount and intensity of surface fire predicted under this alternative could have long-term adverse effects to sensitive and endemic species.

Direct and Indirect Effects

Continued unabated fuels accumulations in stands that already have high fuel loads would increase the likelihood of high-severity wildfire in the project area, which could result in various impacts to the sensitive and endemic botanical species addressed in this analysis.

The effects of a wildfire on Sensitive or Forest Plan Endemic species in the project area would depend mostly on 1) the season (e.g. spring, summer or fall) with regard to the biology of the species in question, 2) the expected flame lengths, and 3) the type of fire (e.g. surface, passive crown, active crown).

The Sensitive and Forest Plan Endemic species discussed in this analysis and their associated ecological communities have evolved and existed in a fire-dependent ecosystem (Skinner et al. 2006); therefore, they may be expected to survive or respond positively to low- or moderate-intensity wildfire. High-intensity wildfires of the size and severity that have occurred recently, however, were not historically typical in most coniferous forests in the Klamath Mountains Bioregion. Many native plant species may not be resilient to that level of disturbance (an exception to this response, however, may be within chaparral shrub communities, which have evolved to regenerate following high-intensity, stand-replacing events).

Burning of aboveground reproductive structures or lethal soil temperatures that can kill underground reproductive structures may cause adverse impacts to some plant species (Knapp 2012 personal communication), including *Cypripedium fasciculatum*, *C. montanum* and *Ageratina shastensis*.

Ectomycorrhizal fungi (such as *Boletus pulcherrimus* and *Phaeocollybia olivacea*) are interdependent with their host trees (e.g. *Quercus* or *Pinus* spp.); they exchange nutrients, mineral and water via hyphal[22] networks acting as root extensions and connectors between individual trees. Due to this interdependent relationship, the vitality of these fungal species is largely dependent on their host trees. In the event of a high-intensity wildfire, host trees may be top-killed, thus decreasing the vitality of these fungi (Visser 1995, Southworth et al. 2011). Studies have shown, though, that low-intensity wildfires do not necessarily reduce the species richness or community structure of ectomycorrhizal fungi (Jonsson et al. 1999, de Roman and de Miguel 2005).

[22] Hyphae are fine, branching tubes which make up the body (or mycelium) of a multicellular fungus.

Trees or snags that fall during a wildfire or are cut during fire suppression could cause adverse impacts to individual plants. Wildfire suppression may also require the creation of dozer fire lines, which could adversely impact those sensitive or endemic species or habitat that occur where firelines are constructed.

The removal of overstory canopy from an active crown fire would have an adverse indirect effect to some sensitive plant species due to increased solar radiation which, in turn can lead to reduced soil moisture, and increased plant evapotranspiration and desiccation.[23]

In the event of an active crown wildfire, heavy modifications in the forest canopy could be severe enough to eliminate or reduce necessary habitat characteristics, such as shade, critical for native and rare species' survival. In particular, species such as *Boletus pulcherrimus, Cypripedium fasciculatum and C. montanum,* and *Phaeocollybia olivacea,* which often occur in mature and late-seral mixed conifer forested areas, could be adversely impacted over the long-term by a loss of suitable habitat from a high-severity wildfire.

Riparian or generally mesic-associated species such as *Boletus pulcherrimus, Cypripedium fasciculatum and C. montanum, Lewisia cantelovii,* or *Neviusia cliftonii* may also be affected by a loss of suitable habitat in the event of a high-intensity wildfire; however, since these species typically grow in moist environments where fire is less able to proliferate, negative impacts from these fire events may be more minor to moderate and shorter-term.

Similarly, species growing in more open habitats (e.g., *Clarkia borealis* ssp. *borealis, Eriastrum tracyi, Lewisia cantelovii, Fritillaria eastwoodiae,* or *Sedum obtusatum* ssp. *paradisum*) may experience only short-term minor adverse impacts due to the limited presence of other vegetation needed to carry fire (e.g. rocky outcrops, roads); however, several of these species (e.g. *F. eastwoodiae*) tend to grow in openings within coniferous forests and cannot necessarily tolerate a complete loss of overstory canopy. Conversely, the opening of the canopy from a dense vegetative condition would have a short-term moderate beneficial effect to these species as well.

A low-intensity surface fire would damage some above-ground portions of individual plants, while underground portions would be unaffected, and plants would recover in the short term. A surface fire within riparian/mesic habitats would likely benefit *Boletus pulcherrimus, Cypripedium fasciculatum* and *C. montanum, Lewisia cantelovii,* and *Neviusia cliftonii* populations indirectly by reducing riparian vegetation cover and competition for understory resources (moisture, substrate, soil minerals, understory light), resulting in increased viability of these populations, until riparian vegetation recovers.

A high-intensity surface fire – hot enough to sterilize the soil to depths below 5 centimeters (2 inches) – would have adverse effects on species with requisite mycorrhizal associates (e.g. *Boletus pulcherrimus, Cypripedium fasciculatum* and *C. montanum*) as the mycorrhizae could be reduced or eliminated. In addition, soil cover (e.g. woody debris, litter, duff) could be reduced which would also adversely impact the structural stability of many plant species. Nutrients stored in the organic layer (such as potassium and nitrogen) vital for plant growth can also be lost or reduced in a high-intensity surface fire.

With respect to known populations of Sensitive species, Clarkia borealis ssp. borealis and Fritillaria eastwoodiae are modeled for mainly crown fire and very high flame lengths with

[23] Desiccation is the state of extreme dryness, or the process of extreme drying.

minor mixtures of surface fire and low flame lengths. Clarkia borealis ssp. borealis, though, was noted to have "benefited" from a mixed severity wildfires (e.g. the Fountain Fire of 1992 (USDA Forest Service 2012), the Bagley fire of 2012 (Nelson 2012 personal communication); thus this species may be expected to flourish post-wildfire if the event did not take place during flowering (June-September) and/or did not reach temperatures hot enough to kill this species' seeds residing in the duff or soil layers. Of the eight Neviusia cliftonii populations within the project area, all populations are also mainly predicted to fall within crown fire and very high flame length areas. A few areas within N. cliftonii populations, however, that are adjacent to a stream would likely experience passive crown fire and lower flame lengths than those in upland communities.

A high-severity wildfire event could also create favorable conditions (e.g., open canopy, decreased number of native species for resource competition) for noxious weed invasion. A noxious weed invasion would have the potential to displace native species via various mechanisms. As there are several known occurrences of noxious weeds in the project area at this time (see Non-Native Invasive Plant Species Report for further information), this would likely be a moderate long-term adverse effect.

Cumulative Effects

As noted in the Wildfire and Fuels and Native Vegetation sections of this chapter, implementation of the no action alternative would increase the risk of a future widespread, high-intensity fire with resulting detrimental effects to vegetation in the project area. Such a fire would be likely to damage or kill sensitive and endemic botanical species and/or adversely impact their habitat.

Adversely impacted habitats would have a long-term adverse effect on sensitive and endemic species' abundance and distribution. Some species that may resprout from rhizomes or bulbs (*Cypripedium fasciculatum* and *C. montanum, Fritillaria eastwoodiae*, or *Neviusia cliftonii*) may remain relatively unaffected by wildfire in the long term. There are also observations of *Clarkia borealis* ssp. *borealis* having been described as 'flourishing' many years after a wildfire (i.e. the Fountain Fire of 1992) (USDA Forest Service 2012), which illustrates the possibility of possible beneficial long-term effects to some species. In general, however, information is lacking and further study is needed.

In the absence of a wildfire, denser multi-storied stands comprised primarily of shade-tolerant species (e.g. *Boletus pulcherrimus, Cypripedium montanum, C. fasciculatum, Phaeocollybia olivacea*) would likely increase, while species such as *Clarkia borealis* ssp. *borealis, Eriastrum tracyi, Fritillaria eastwoodiae, Lewisia cantelovii*, and *Sedum obtusatum* ssp. *paradisum* that need either gaps in the canopy or open conditions would likely decrease in abundance, although some roadside or trailside populations may persist.

If Shasta Dam were raised by 18.5 feet[24], as is currently proposed by the Bureau of Reclamation (USDI Bureau of Reclamation 2007), approximately 2,498 acres of land would be inundated (1,015 acres within the project area), which would account for a minor loss (maximum of two percent) of potential suitable habitat for all of the species discussed; however, the effect would

[24] Shasta Dam raise lake inundation GIS data were provided from Shasta-Trinity N.F. personnel. The data pertains to 1090' contour elevation information around the shoreline of Shasta Lake in Shasta County, California. The contour line was extracted from CAD data that were generated through a photogrammetry contractor per the direction of the Bureau of Reclamation.

be long-term. Of the 21 occurrences of Neviusia cliftonii, approximately 10 are modeled for inundation in the event of an 18.5 foot Shasta dam increase. Three of the eight occurrences of *Neviusia cliftonii* that are documented within the project area are modeled for inundation. Additionally, there are four known occurrences of Neviusia cliftonii within the I-5 Corridor project area (two modeled for inundation). Furthermore, two populations of *N. cliftonii* on private land are vulnerable to commercial impacts of limestone quarrying (USDA Forest Service 2012). Thus, if the five non-inundated *N. cliftonii* occurrences within the project area were to be adversely affected by a severe wildfire, a total of 15 out of the 21 known occurrences of *Neviusia cliftonii* would experience major adverse effects over the long-term. Therefore, the reduction of high-severity effects from a wildfire from either action alternative within the Green-Horse project would have a major long-term beneficial effect to this species effects.

As there are a limited number of known populations (15) of *Ageratina shastensis*, the potential loss or damaging of two populations within the project area in the event of a wildfire, coupled with the potential loss of habitat from if Shasta Dam is raised and possible effects from other projects (see Appendix A.), a moderate long-term adverse effect to this species would be likely to occur with implementation of no action.

No other populations of Sensitive or Forest Plan Endemic species are modeled for inundation; however, there is some habitat loss predicted for all of them. Other activities, such as timber harvest on private or public lands, when paired with a severe wildfire, could cumulatively adversely affect these species. Although future projects in the analysis area (see Appendix A) may offset some of the potential adverse impacts from wildfires to populations of sensitive botanical species in the area, a high-severity wildfire event would likely have major adverse effects for sensitive botanical species; especially those requiring moist, shady environments (e.g. *Boletus pulcherrimus, Cypripedium fasciculatum, C. montanum,* or *Phaeocollybia olivacea*).

Conclusion

A low-intensity surface fire – predicted in 31 percent of the project area under no action – or portions of a passive crown fire would result in negligible adverse short-term direct effects and minor-to-moderate beneficial short-term indirect effects on all aforementioned botanical species.

A high-intensity surface fire – predicted in 0.03 percent of the project area would result in adverse short-term direct effects to all sensitive and endemic botanical species due to severe habitat alteration and long-term moderate adverse indirect effects to *Boletus pulcherrimus, Cypripedium fasciculatum* and *C. montanum*.

Active crown fire – predicted in 63 percent of the project area – or possibly some areas of passive crown fire that removes a large percent of the overstory canopy would result in a moderate long-term adverse indirect effect to all sensitive and endemic botanical species, with the possible exception of *Clarkia borealis* ssp. *borealis, Eriastrum tracyi, Lewisia cantelovii, Fritillaria eastwoodiae,* or *Sedum obtusatum* ssp. *paradisum,* which may experience short-term beneficial effects due to the opening of the canopy and the creation of new habitat.

Effects Common to Alternatives 2 and 3

Implementation of Alternative 2 or 3 could result in direct, indirect, or cumulative impacts as discussed below. Prescribed fire, hand thinning, hand piling, and pile burning are common to both action alternatives.

Direct and Indirect Effects

Prescribed Fire

The most significant direct effect of prescribed fire under either action alterative would be the consumption of plant tissues – above or below ground – and the potential resulting mortality of individual plants or fungi. Prescribed burning within the project area is predicted to result in low-severity impacts to sensitive and endemic species due to the low flame lengths and absence of active crown fire expected from implementation.

Ninety and 95 percent of the acres within Alternatives 2 and 3 treatment units, respectively, are projected to experience surface fire with the remainder predicted to experience passive crown fire. All surface fire in the project area is predicted to be of low intensity and would likely result in a low level of plant or fungi mortality; however, it is possible for a surface fire to burn at low to moderate intensity yet consume the forest floor and damage sprouting tissues (Brown and Smith 2000), resulting in moderate- to high-severity impacts.

Timing or season of implementation of prescribed fire may affect its direct impacts to botanical species. Although conditions specified in the burn plan would direct the application of prescribed fire, it is also likely that periods during which sensitive and endemic species would be flowering would generally indicate conditions outside of the burn plan (e.g., high fuel moistures).

While the removal of overstory canopy from an active crown fire could have an adverse indirect effect to some sensitive plant species due to increased solar radiation, and a surface fire may also increase solar radiation (as noted in the effects discussion for Alternative 1), under either action alternative these adverse effects would be minor due to the small percentage of area projected for active crown fire.

The areas projected for passive crown fire could reduce the overstory canopy within individual trees or small groups of trees. Because passive crown fire does not typically result in a high amount of canopy removal and because only a small percentage of the project area is modeled for this outcome, the adverse effects from this would be minor and short term.

Indirect beneficial effects of passive crown fire, and/or areas with very low or low flame lengths would include the eventual development of late-successional characteristics from the opening-up of the canopy and the mimicking of natural disturbance cycles. The indirect effects of treating fuels under a prescribed burn scenario would also result in lower vegetation severities during possible future wildland fires.

Indirect beneficial effects of a low-intensity surface fire (90-95 percent of Alternatives 2 and 3) include a reduction in the density of surrounding vegetation and duff which would decrease competition for nutrients and light. Additionally, the cycling of these vegetation materials would release nutrients (e.g. nitrogen) for native plant use and enhance soil development and fertility over the long term. Furthermore, implementation of prescribed fire treatments prior to wildfire events is likely to reduce future wildfire burn severity thus benefitting most sensitive plant species in the project area.

Indirect effects to all sensitive botanical species may also occur from a potential increase in available habitat for invasive weeds (Keeley 2006). This would depend on many factors such as distance to already-established invasive plants, season of burn (e.g. a spring burn may mean lower fuel consumption and less bare substrate exposed for invasives), distance to roads or other

disturbed areas, the species in question, etc. In particular, *Neviusia cliftonii* has at least one occurrence near a large Himalayan blackberry population; however, the incorporation of botanical design features would minimize this adverse indirect effect to this species.

Riparian-associated species: Direct effects to sensitive and endemic species growing in moist environments (e.g., riparian zones, bogs, fens, seeps) would likely be negligible-to-minor due to the higher fuel moisture and humidity than those that typify drier sites. In addition, ignition/burning within riparian reserves would be restricted, thus reducing the potential for impacts to these riparian-associated species. These species include:

Boletus pulcherrimus *Cypripedium fasciculatum* *Cypripedium montanum*

Mielichhoferia elongata *Neviusia cliftonii*

Indirect effects to these species would likely be negligible to minor due to the high fuel moistures and humidity within these habitats which generally decrease the likelihood of overstory canopy consumption. A surface fire within mesic habitats would benefit the aforementioned populations indirectly by reducing riparian vegetation cover and competition for understory resources (moisture, substrate, soil minerals, understory light), resulting in increased viability of those populations, until riparian vegetation recovers. A moderate to hot surface fire could, though, indirectly adversely affect *Cypripedium fasciculatum* or *C. montanum* populations by reducing or eliminating critical mycorrhizal associates.

Rock outcrop species: Species growing on rocky outcrops would likely be at low risk of direct adverse effects (i.e. mortality through burning) or indirect adverse effects from canopy loss since there is little surrounding continuous vegetation within that habitat to carry fire, although if sufficient surrounding vegetation were present individuals could be killed. These species include:

Lewisia cantelovii

Mielichhoferia elongata

Sedum obtusatum ssp. *paradisum*

The loss of habitat for these species should be minor also due to the low vegetation severity expected from very low flame lengths and low intensity of surface fires. *Lewisia cantelovii* occurs in very wet outcrops which would have an extinguishing effect on creeping fire. If rock outcrops were utilized for natural barrier during prescribed fire operations some negligible short-term adverse effects (i.e. trampling) could occur. The potential direct adverse effects to these species would be minor and short-term due to the aforementioned factors.

Open canopy/disturbed habitat species: Some species also grow in somewhat open-canopy and/or disturbed areas, thus direct adverse effects would be minimal. These species include:

Clarkia borealis ssp. *borealis*[25]

Fritillaria eastwoodiae

[25] Prescribed fire would not be allowed within 100 feet of known northern clarkia (*Clarkia borealis* ssp. *borealis*) unless there is evidence (approved by the Forest botanist) that shows the impacts of prescribed fire to be neutral or beneficial (design feature BOT-7).

Additionally, as *F. eastwoodiae* species is a bulb, application of a low-intensity surface fire would not damage critical below-ground tissues of this plant.

These species may experience an indirect adverse effect from canopy loss in cases of active crown fire where large portions of the canopy are consumed. Active crown fire is predicted for less than one percent of suitable habitat for all of these species, so the indirect adverse effect would be minor but may be long-term. Passive crown fire would occur in approximately 9 percent of these species' habitat and would have a moderate short-term beneficial effect on these species by creating more edge-canopy gap habitat (i.e. limiting encroachment by dense shrubs or trees).

As previously noted, a *Clarkia borealis* ssp. *borealis* occurrence can be found at the site of a previous (1992) high- severity fire and another occurrence with several thousand plants can be found on a roadcut and gravel roadside and fill slope (Nelson 2012 personal communication). Thus, some canopy reduction would result in a long-term minor beneficial indirect effect to these species.

Fungi: It has been shown that there is a loss of fungal biomass in the upper litter and soil layers following surface fire (Stendell et al. 1999, Smith et al. 2004) – particularly after a fall burn – which could have a minor adverse effect on the vitality of species such as *Boletus pulcherrimus* and *Phaeocollybia olivacea*. It has also been shown that mycorrhizal associates can survive in the deeper portions (below 5 centimeters) of the mineral soil (Smith et al. 2004, Visser 1995) where a low-intensity surface fire would likely not penetrate. In particular, *P. olivacea* has an extremely long stem that can extend for more than 0.3 meter into the soil.

These species typically fruit during wetter periods of the year which is often in contrast to optimal conditions for the application of prescribed fire. Therefore, above-ground fruiting bodies would likely not be present during time of implementation; however, this is not a certainty. Due to these aforementioned reasons, adverse effects to these species would likely be negligible-to-minor.

A passive or active crown fire may indirectly affect occurrences of *Boletus pulcherrimus* or *Phaeocollybia olivacea* in non-riparian zones if suitable habitat elements are impacted. For example, if canopy removal is extensive enough to drastically reduce adequate moisture levels, or if the mycorrhizae on tree roots are damaged, individuals would be indirectly affected. These species' riparian habitat, however, would burn with low intensities so that suitable fungi habitat would be maintained.

A passive or active crown fire would result in an indirect minor long-term adverse effect as some suitable fungi habitat would be damaged and/or the mycorrhizal associates of *Boletus pulcherrimus* or *Phaeocollybia olivacea* would also be reduced. Populations would persist or recover in the long term, and any impacted habitat elements would recover in the long term.

Neviusia cliftonii (Shasta snow wreath): Since *Neviusia cliftonii* was only recently discovered in the Shasta Lake region, it is unclear how long this species has persisted in the area. The historical impacts of fire or fire exclusion are therefore unknown. As previously mentioned, any direct impacts on *Neviusia cliftonii* within riparian zones from prescribed burning would be negligible-to-minor. Some occurrences of *N. cliftonii* exist in more upland habitats, however, and it is unknown how fire may affect populations within this ecotype. This species is rhizomatous, so underground stems may produce vegetative growth if the plant is top-killed. *N.*

cliftonii plants were observed to grow back after being cut for a fire break on the Waters Gulch trail (USDA Forest Service 2012).

Currently a monitoring study is underway for *N. cliftonii* – in both riparian and upland habitats – which may provide valuable information on this species as well as its response to fire. Three of the eight known occurrences within the project area (one of the four in Alternative 3 proposed treatment areas) – Campbell Creek, Curl Creek, and Low Pass, Creek – have been chosen for this study (see the project file for selection criteria), and one population within the five-mile analysis area has already had prescribed fire applied to it. Although no formal analysis has been completed on this study, anecdotal observations have noted a vigorous resprouting response from N. cliftonii plants within the prescribed burn areas (Butz 2013 personal communication). Design features (BOT-4) excluding prescribed fire within 100 feet of all other known occurrences would minimize direct adverse impacts from prescribed fire.

As previously noted, *Neviusia cliftonii* does not solely reside in riparian areas; passive crown fire (modeled to occur in 9 percent of *N. cliftonii* habitat) may have dry enough vegetation nearby to carry fire. As less than one percent of the habitat would experience an active crown fire, the adverse indirect effects would likely be minor and short term.

The reduction in surrounding vegetation from surface fire could favor *N. cliftonii* as competition for resources would be reduced. Furthermore, *N. cliftonii* is a rhizomatous plant that allows for resprouting. Many rhizomatous plant species are known to respond favorably to fire and minor disturbances (Fites-Kaufman et al. 2006). These conditions could result in increased vigor and distribution of this species, which would be a long-term moderate beneficial effect.

Eriastrum tracyi (Tracy's eriastrum): *Eriastrum tracyi* occurs in openings in cismontane woodlands or chaparral and has been anecdotally noted to withstand minor disturbances, although empirical research supporting this observation is lacking (USDA Forest Service 2012). According to a recent species account, Eriastrum tracyi appears to tolerate or benefit from infrequent disturbance and wildfire (USDA Forest Service 2012). This species could be directly consumed via surface fires; however, no occurrences for this species are known to occur within the project area. Habitat suitability may also be directly adversely impacted; however, surface fire is unlikely to completely remove the closed-cone pine forests or chaparral habitats in which this species occurs' therefore, direct effects would be minor and short-term.

Passive and active crown fires would remove some or all chaparral, hardwood, and conifer canopy cover. Passive crown fire or low-intensity surface fire would likely have a short-term, minor indirect beneficial effect of providing canopy openings and reducing an overly-dense vegetative condition for this species. A high-intensity surface fire would have a negligible short-term effect due to the small area predicted for this type of fire under either action alternative.

Ageratina shastensis (Shasta eupatory): It is unknown how this Forest endemic shrub species responds to fire; therefore, prescribed fire may directly affect this species. Project design features BOT-2 and BOT-3 would reduce the potential for direct adverse effects.

Approximately 90 to 95 percent of prescribed fire under Alternatives 2 and 3 is predicted to experience surface fire. As previously noted, it is possible for surface fire to consume or damage botanical species – including occurrences of *A. shastensis*. However, all of the surface fire in the project area is modeled for low intensity and very low (less than 1 foot high) to low (1-4 feet high) flame lengths, suggesting that shrub consumption is unlikely. This species has a woody

stem that produces leaves and could potentially regenerate after a surface fire. For these reasons, any adverse direct effects from prescribed fire would be minor and short-term.

If encroachment of habitat by dense shrubs or trees limits openings for *Ageratina shastensis*, the proposed prescribed fire may improve habitat conditions for this species throughout the project area by reducing the density of competing vegetation. This would result in a moderate short term beneficial indirect effect.

If the overstory canopy were reduced to the point of allowing excessive solar radiation and subsequent drying of the soils, it is possible this would have an adverse indirect effect to *A. shastensis*. However, because active crown fire is predicted for less than one percent of suitable habitat area, this would be a negligible adverse effect.

Conversely, as this species tends to inhabit more open areas, the opening of the overstory canopy via passive crown fire (predicted in approximately 9 percent of suitable habitat), or the reduction of competing vegetation through surface fire (90-95 percent of suitable habitat), would have a short-term minor beneficial effect to *A. shastensis*.

Hand Thinning, Pruning, Hand Piling and Pile Burning

Project design features would ensure that hand thinning and pruning of small trees and brush would have little to no effect on known occurrences of sensitive or endemic botanical species (design features BOT-1 through BOT-7).

High soil temperatures associated with burn piles could have indirect adverse effects to sensitive and endemic species (e.g. *Boletus pulcherrimus, Cypripedium fasciculatum, C. montanum,* or *Phaeocollybia olivacea*) via damage to mycorrhizal associates, thus reducing their vigor. In addition, native seedbanks of could be reduced or eliminated in localized areas. Design features would minimize potential impacts to riparian species by limiting construction or burning of piles within riparian reserves.

Additionally, if soil sterilization were to occur due to high temperatures this would create small areas of hydrophobic soils resulting in reduced infiltration, increases in erosion, and decreases in water and nutrient availability – thus decreasing suitable habitat for sensitive botanical species. More suitable habitat would be created, though, for noxious weeds which can colonize and thrive in such environments (Keeley 2006). The limited extent of this proposed treatment (less than one percent of either action alternative), however, coupled with the indirect beneficial effects, would limit the adverse indirect effects to minor and short term.

Potential impacts to suitable sensitive plant habitat from hand thinning, pruning, hand piling or pile burning would occur in a maximum of 0.5 percent of the available suitable habitat for all sensitive botanical species predicted to occur under either action alternative. Direct adverse effects to sensitive botanical species would, therefore, be negligible and short-term. These activities would likely result in minor indirect affects (both beneficial and adverse) to botanical species.

Riparian-associated species: For species that occur within riparian reserves (e.g. *Boletus pulcherrimus, Cypripedium fasciculatum, C. montanum, Lewisia cantelovii,* and *Neviusia cliftonii*), project design features would be implemented to minimize adverse impacts from pile burning within these areas.

Rock outcrop species and Open-canopy/Disturbance species: If encroachment of habitat by dense shrubs or trees limits openings for species such as, *Clarkia borealis* ssp. *borealis*, *Fritillaria eastwoodiae*, *Lewisia cantelovii*, or *Sedum obtusatum* ssp. *paradisum*, the proposed reduction in density of competing trees and shrubs through hand thinning may improve habitat conditions for these species throughout the project area.

Fungi: *Boletus pulcherrimus* and *Phaeocollybia olivacea* may not be identifiable at the time of project implementation; it is expected that because fungal and plant root biomass can reach much lower depths than 5 centimeters (2 inches) – the measure where high soil temperatures are thought to have the most damaging effects (Smith et al. 2004) – these species should survive the temporary heat produced by pile burning. It should be noted, however, that a fall burn causes higher fungal biomass loss than a spring burn (Smith et al. 2004).

Although a concentrated burn may affect fungal species more intensely than a broadcast burn, the effects of burning piles are more localized and therefore minor. Recovery and reintroduction of any populations of these fungal species from residual fungal biomass in the areas surrounding burn piles would be expected to occur.

Neviusia cliftonii (Shasta snow wreath): It is unknown how *Neviusia cliftonii* may respond to an opening of the canopy through hand thinning. Although trampling of species or accidental pruning of a shrub-like species such as *Neviusia cliftonii* is possible (an adverse effect), any hand thinning/weeding occurring near known *N. cliftonii* would be conducted with a botanical monitor present (BOT-4).

Cumulative Effects

Alternatives 2 and 3 would reduce the risk of high-severity fire resulting from the cumulative effects of a previous history of fire suppression, a buildup of ground and ladder fuels in the treatment units, and the potential for fire ignitions from the ongoing recreational (boating, hiking, camping) activities in the areas treated. When combined with past and other current and foreseeable projects (e.g., Green Mountain Vegetation Management Project, Bear Hazardous Fuels Reduction Project), the collective benefit of reducing fire hazard across a broad landscape can be realized (see the project Fire, Fuels, Air Quality and Vegetation report). Past fires (e.g. Bear Fire, Jones Fire, and Stein Fire) have already likely reduced habitat for certain sensitive and endemic botanical species in the analysis area (with the potential exception of *Clarkia borealis* ssp. borealis). The action alternatives would mitigate this loss by preventing further loss in the event of a wildfire.

Past wildfires and current or future actions involving ground-disturbing activities (e.g., timber harvest on private lands and the I-5 Corridor Fuels Reduction project) may exacerbate the noxious weed situation and reduce available habitat for sensitive botanical species.

Cumulatively, either action alternative of the Green-Horse project has the potential for moderate long-term adverse effects by increasing habitat for or the spread of weeds. The implementation of design features, coupled with noxious weed removal activities such as the reasonably foreseeable Packer's Bay project, would reduce the cumulative effects to negligible-to-minor long-term. In particular, the Packer's Bay project would have long-term beneficial impacts to native vegetation, particularly a documented population of *Neviusia cliftonii*, by reducing invasive brooms (C*ytisus scoparius, Genista monspessulana*, and *Spartium junceum*).

A secondary benefit of reducing the risk of high-severity fire is the prevention of a potential weed infestation that often results from these types of fires and their corresponding suppression

activities. The prevention of a weed infestation would benefit all botanical species analyzed in this report by avoiding competition that could lead to a decline in native vegetation and sensitive botanical populations – and their viability.

As under Alternative 1, if Shasta Dam were raised by 18.5 feet[26] (USDI Bureau of Reclamation (BOR) 2007) (as is currently proposed by the Bureau of Reclamation) approximately 2,498 acres of land would be inundated (1,015 acres within the project area), which would account for a minor loss (maximum of two percent) of potential suitable habitat for all of the species discussed; however, the effect would be long-term. This would likely affect riparian-associated species (e.g. *Lewisia cantelovii, Neviusia cliftonii*) more than upland species. Of the potentially inundated lands, 114 acres are limestone (27 acres within the project area), which would specifically affect species with a limestone affinity – such as *A. shastensis*. In addition, approximately two percent of overall habitat for *A. shastensis* (limestone and non-limestone) would likely be inundated – which includes one of the two known occurrences within the project area.

Neviusia cliftonii (Shasta snow wreath): As noted previously, 10 of the 21 known occurrences of *Neviusia cliftonii* would likely be inundated if Shasta Dam is raised by as much as 18.5 feet. It was determined that a high-severity wildfire such as is predicted to occur under Alternative 1 – when combined with the potential loss of almost half the known worldwide population to inundation – would have major long-term adverse effects to *N. cliftonii*. Therefore, the reduction of high-severity effects from a future wildfire under either action alternative within the Green-Horse project area would have a major long-term beneficial effect to this species.

As previously noted, since it is currently unknown how *N. cliftonii* responds to low-intensity surface fire, it is possible that some adverse or beneficial effects to this species may result from either action alternative within the Green-Horse project area. The proposed adaptive management strategy and project design features BOT-2, BOT-4 and BOT-5 would allow for adjustments to implementation based on monitoring this species' response to prescribed fire. Additionally, the proposed actions would occur over a period of 7-10 years, with only portions of the project area being burned at different intervals. Due to the distributed nature of the *N. cliftonii* occurrences within the project area, this would result in only a subset of the populations having treatments applied nearby in any given entry. The effects from either action alternative would not be expected to lead to a trend toward federal listing for this species.

Fritillaria eastwoodiae (Butte County fritillary): Of the five *Fritillaria eastwoodiae* populations within the project area, two are modeled for inundation (none of the populations within Alternative 3 treatment areas would be inundated). Two additional populations are documented in the analysis area within the I-5 Corridor project area. Although a wildfire in the project area, coupled with other potential project effects, could have an adverse effect on this species, the high number of occurrences throughout northern California (212) would allow for some loss without likely leading to a trend toward federal listing.

Clarkia borealis ssp. ***borealis*** (northern clarkia): Neither of the two occurrences of *Clarkia borealis* ssp. *borealis* within the project area (Alternative 2 or 3) is modeled for inundation if

[26] Shasta Dam lake inundation GIS data were provided from Shasta-Trinity N.F. personnel. The data pertains to 1090' contour elevation information around the shoreline of Shasta Lake in Shasta County, California. The contour line was extracted from CAD data that were generated through a photogrammetry contractor per the direction of the Bureau of Reclamation.

Shasta Dam is raised; however, one is modeled for active crown fire and very high flame lengths in the event of a wildfire, and the other falls within an approved (in 2007) clearcut polygon on private land. Two populations outside of the project area (near Campbell Creek and Sugarloaf Creek) are modeled for inundation. Although a wildfire in the project area, coupled with other potential project effects, could have an adverse effect on this species, the moderate number of occurrences throughout Shasta County (47) would allow for some loss without likely leading to a trend toward federal listing.

As noted previously, the raising of Shasta Dam could impact individuals of *Ageratina shastensis* within the project area. Considering this potential, the potential for adverse or beneficial effects from other foreseeable projects (e.g., Packers Bay Invasive Species Removal Project), and the potential for some direct and indirect effects to *A. shastensis* from either action alternative, cumulative effects to this species would be expected to be moderate and short term, with minor to moderate short-term benefits.

One population of *Lewisia cantelovii* outside the analysis area is modeled for inundation if Shasta Dam is raised. As was noted previously, there would likely be negligible direct or indirect adverse impacts to this species as a result of implementing either action alternative, so the cumulative impacts would also remain negligible.

Determination Summary

Based on the above analysis of the action alternatives, using the most current available scientific information, we determined that implementation of either action alternative may impact, but is not likely to lead to a trend toward Federal listing or loss of viability for the 11 Forest Service Sensitive species analyzed (*Boletus pulcherrimus, Clarkia borealis* ssp. *borealis, Cypripedium fasciculatum, Cypripedium montanum, Eriastrum tracyi, Fritillaria eastwoodiae, Lewisia cantelovii, Mielichhoferia elongata, Neviusia cliftonii, Phaeocollybia olivacea,* and *Sedum obtusatum* ssp. *paradisum*).

Due to its habitat requirements and the fire type and intensity modeled for the action alternatives, implementation of either action alternative – with the proposed design features for this species – would likely have a minor-to-moderate beneficial short-term effect for the Forest Plan Endemic *Ageratina shastensis* individuals and habitat.

Alternative 2 – Proposed Action

The effects described above under Effects Common to Alternatives 2 and 3 would be expected to occur where suitable sensitive and endemic plant habitat occurs in the proposed 41,836 acres of treatment proposed under this alternative. Some potential effects to sensitive and endemic plant species are unique to Alternative 2.

Direct and Indirect Effects

Dozer Line Construction or Reconstruction

The proposed four acres of dozer line construction or reconstruction would occur along ridgelines in primarily mid-seral Douglas-fir – Pine and/or Black Oak vegetation types between elevations of 1,100 to 2,500 feet. Species with the highest potential to occur within the proposed dozer lines include: *Eriastrum tracyi* (USDA Forest Service 2012), *Sedum obtusatum* ssp. *paradisum*, *Fritillaria eastwoodiae*, and *Clarkia borealis* ssp. *borealis*.

It is very unlikely, but possible, that the following species could occur in the proposed dozer lines: *Mielichhoferia elongata, Neviusia cliftonii,* and *Phaeocollybia olivacea*. Habitat for the remaining sensitive species does not occur in this area; therefore, there would be no effects to these species from dozer line construction or reconstruction.

No dozer lines would be constructed within 50 feet of any documented Sensitive plant species populations. Unknown occurrences, however, could be directly affected via the crushing/trampling of aboveground portions of plant tissues. Additionally, belowground plant tissues could be directly damaged causing mortality.

Indirect adverse effects would include the creation of a bare soil substrate which could: 1) increase erosion and soil loss thus destabilizing suitable habitat for sensitive botanical species; 2) increase solar radiation to the soil (thus drying it out) via the removal of litter and duff; and 3) increase the available habitat for noxious weeds (Merriam et al. 2006), which may then displace native species. There are no noxious weed occurrences documented within these areas; however, field surveys did not comprehensively cover all proposed dozer line acres. Therefore, unknown invasive occurrences may exist. Project design features would be implemented to minimize erosion, to maintain adequate soil cover and to reduce the risk of noxious weed establishment or expansion.

Some soil compaction – which would also reduce sensitive botanical species' habitat quality – could occur as a result of dozer line creation; however, because of the small amount of acreage impacts would be negligible.

Indirect beneficial effects include the possible creation of habitat for sensitive botanical species known to be disturbance followers, *Clarkia borealis* ssp. *borealis*.

Forest Plan Amendment

Under this alternative, dead/down material in Management Prescriptions II and III would average 5 – 15 tons/acre after project implementation as opposed to current Forest Plan standards that require an average of 20 tons per acre and 10 tons per acre, respectively. Dead and down material would be reduced; however, project design feature WATER-2 would ensure sufficient surface organic matter is retained to protect soils. Conversely, if the area is not treated, the risk to soil productivity is much greater from a high-severity wildfire. Modification of the dead/down requirement in those two management prescriptions would, therefore, indirectly benefit Sensitive and FPE botanical species.

Cumulative Effects

Because the proposed dozer fireline construction or reconstruction would occur on only four acres of potential sensitive and endemic plant habitat, this activity would likely have short-term negligible benefits to *Clarkia borealis* ssp. *borealis* when combined coupled with the previously mentioned past, current, and foreseeable actions.

There would be short-term minor and long term negligible adverse impacts to *Eriastrum tracyi* (Merriam et al. 2006), *Sedum obtusatum* ssp. *paradisum, Clarkia borealis* ssp. *borealis*, *Fritillaria eastwoodiae, Neviusia cliftonii,* or *Phaeocollybia olivacea*. There would be no effect to *Boletus pulcherrimus*, *Cypripedium fasciculatum, C. montanum,* and *Lewisia cantelovii*.

Alternative 3 – No Forest Plan Amendment

The effects described above under Effects Common to Alternatives 2 and 3 would be expected to occur where suitable sensitive and endemic plant habitat occurs in the proposed 13,275 acres of treatment proposed under this alternative. The remainder of the project area not treated would likely experience direct, indirect and long-term effects similar to those described for Alternative 1 (no action).

Terrestrial and Amphibian Wildlife Species[27]

The analysis for terrestrial and amphibian wildlife species was conducted in accordance with the legal requirements set forth under Section 7 of the Endangered Species Act of 1973 and following the standards and guidelines established in Forest Service Manual (FSM) 2670 and in the Forest Plan (USDA Forest Service 1995a).

The cumulative effects analysis area for northern spotted owl (NSO) includes habitat within the project area and the area within 1.3 miles around the project area. The 1.3-mile buffer is included to evaluate potential effects to NSOs which in this region use home ranges of roughly this size. This bounding will also capture the area potentially affected by noise disturbance (up to 0.25 mile from the source of noise above ambient levels), and the area potentially affected by smoke (up to 0.25 mile from treatment units or within the drainage feature).

The cumulative effects analysis area for Forest Service Sensitive and other terrestrial and amphibian wildlife species includes the project area and the area within 0.25 mile from the project area.

The time period for measuring effects to terrestrial and amphibian wildlife species is two-part:

- Short-term effects were measured over the implementation period of the project (7-10 years), which captures the potential disturbance-oriented, immediate impacts from project implementation such as smoke or noise.
- Long-term effects were measured over a period of 20 years following implementation or, in the event the no action alternative is selected, 20 years from the date of the decision. This permits us to model ecological conditions for the time needed post-treatment to restore the natural fire cycle and to account for the predicted beneficial effects of reintroducing fire to the project area.

Special Status Terrestrial and Amphibian Wildlife Species

Threatened, Endangered and Proposed Species

Affected Environment

The US Fish and Wildlife Service lists three terrestrial wildlife species as Threatened, Endangered, or Proposed associated in the four USGS topographical quadrangles (Goose Gap, Minnesota Mtn., Devils Rock and O'Brien) within which the project area occurs (USDI Fish and Wildlife Service 2012b). No currently designated Critical Habitat for any federally listed species

[27] The Terrestrial and Amphibian Wildlife section of this DEIS summarizes information contained in the Green-Horse Biological Assessment, Biological Evaluation, Migratory Land Bird Report, Black Bear and Deer Analysis, and Wildlife Report and Executive Summary. The documents are incorporated by reference and are part of the project planning record located at the Shasta Lake Ranger Station.

occurs in the analysis area (USDI Fish and Wildlife Service 2012b). While the project area may be within the historic range of the valley elderberry longhorn beetle and the California red-legged frog, their current range no longer includes areas that would be impacted by the proposed activities (USDI Fish and Wildlife Service1984, USDI Fish and Wildlife Service 2006). The proposed activities would not alter or remove any suitable habitat and would, therefore, have no effect on these species. Therefore, only the northern spotted owl was addressed in detail.

EVEG 2007 (Remote Sensing Data), in conjunction with aerial photography, field verification, and the knowledge and expertise of district and Forest personnel and US Fish and Wildlife Service biologists were used to estimate available northern spotted owl (NSO) nesting/roosting, foraging and dispersal habitat within the project area.

Documented NSO Occurrences

Shasta-Trinity National Forest's northern spotted owl database (NRIS Wildlife) indicates no NSO activity centers or sightings within the analysis area[28]. California Natural Diversity Database (CNDDB) indicates historic, isolated observations of NSO in the analysis area in the past. These observations are all over 20 years old. No known nesting or reproductive pairs of NSO have been observed within several miles of the project area.

Project-level surveys have not been conducted because areas of marginal or very low habitat potential are not surveyed or are routinely excluded from surveys because, according to the survey protocol, surveys should be conducted in areas where a response by a NSO would be expected[29]. NSO territories are not expected to occur in the small patches of the only potentially suitable habitat that is scattered within the northeastern portion of the project area that encompasses approximately 4 percent of the total project area. (Subsection B).

Suitable NSO Habitat

The 2011 Recovery Plan and the Northwest Forest Plan 15-year Monitoring Report identified habitat specific to the Green-Horse project area as having a very low probability of NSO occurrence (USDI Fish and Wildlife Service 2011, Davis et al. 2011). Habitat modeling in the 2011 Recovery Plan and 2012 Critical Habitat rule show the project area as containing no suitable habitat (USDI Fish and Wildlife Service 2012a).

Habitat potential for northern spotted owl is markedly different in the southern and western portion of the project area from that in the northern and eastern portion. Accordingly, the project area was delineated into two distinct subsections for the purposes of evaluating effects to NSO.

<u>Subsection A – No Suitable NSO Nesting/Roosting or Foraging Habitat</u>

Subsection A consists of the western portion of the project area and encompasses Horse Mountain and all of the project area between the McCloud Arm and Squaw Arm of Shasta Lake. Subsection A also includes the southeastern portion of the project area where Green Mountain is situated between the Pit Arm and Squaw Arm of Shasta Lake, north to Brock Mountain. Subsection A has no suitable NSO nesting/roosting or foraging habitat and no record of any NSO occupancy, current or historic.

[28] Defined above as a 1.3 mile buffer around the entire project area.

[29] From the 2010 NSO Survey Protocol, Section 3.3, page 7: the survey area (is) where protocol surveys may elicit a response from a resident owl or pair of owls (i.e., nesting/roosting, or foraging habitat). The survey effort need not include stands typically characterized as spotted owl dispersal habitat that does not normally function as nesting, roosting, or foraging habitat for territorial spotted owls."

Only dispersal habitat is present in Subsection A – in the form of areas with tree cover / canopy closure greater than 50 percent – and has minimal opportunities for foraging. Cover is present in the form of oak woodland, ponderosa pine-knobcone and mixed pine-chaparral vegetation types. Subsection A contains unsuitable vegetation type, temperature and moisture regime, and insufficient cover throughout the majority of the area to be classified as functional dispersal habitat.

Subsection B – Potential Suitable NSO Nesting/Roosting and Foraging Habitat

Subsection B consists of the remaining project area and includes the small isolated stands that are structurally similar to marginal nesting/roosting habitat, in addition to approximately 70 percent (1,300 acres) of the Madrone Managed Late Successional Area (MLSA). See table 3-17 below.

Table 3-17. Total acres and amount of potentially suitable NSO habitat within Subsection B of the project area by land allocation– Alternatives 2 and 3

Subsection B NSO Habitat	Alternative 2		Alternative 3	
	Acres	MLSA*	Acres	MLSA*
Acres of potential NSO nesting/roosting habitat	819	189	514	189
Acres of potential NSO foraging habitat	849	62	575	62
Total acres of potential NSO nesting/roosting and foraging habitat	1,668	251	1,089	251

*The MLSA acres are not additive but are included within the total acres of nesting/roosting and foraging habitat.

Subsection B contains the only habitat with any likelihood of use by NSO for nesting/roosting or foraging, though the likelihood is still fairly low. The quality and overall suitability for nesting/roosting varies with abiotic features such as topography, slope, aspect and distance to water. While suitable vegetation type and structure may be present, these areas do not necessarily provide all important habitat elements nor are they necessarily located in appropriate juxtaposition (i.e. slope position, aspect, or ridge) that would make them suitable for nesting/roosting or foraging.

The relatively small amount of the nesting/roosting habitat referenced above is scattered across Subsection B and does not represent a contiguous block of habitat; the largest block of 76 acres is separated by approximately 0.25 mile from the next largest block of 33 acres.

Also contributing to the lack of suitability of the project area for NSO, the ambient temperatures are significantly higher in this area relative to the temperature range where NSO would normally occur. The average summer daytime temperature is almost 100°F, and maximum daily temperatures easily exceed 100°F for at least two months of the year. NSO are prone to heat stress and inefficient at dissipating body heat. NSO have a narrow thermal neutral zone when compared to other endemic owl species and have a lower upper critical temperature. Research has shown that NSO can show signs of heat stress when temperatures reach and exceed 81° to 88°F (Barrows 1981).

These factors combine to indicate a very low likelihood that NSO would occupy the project area.

Environmental Consequences

Alternative 1

Direct, Indirect and Cumulative Effects

As demonstrated by the fire and fuels modeling for this alternative described above in the Wildfire and Fuels section, and in light of recent fire history in the area, there is a high likelihood that future high-intensity fire would occur within the project area if no action were implemented. Such a fire would likely result in the loss of what habitat elements for NSO do occur in Subsection B of the project area. The overall effect to NSO, however, would be negligible, given the low probability for NSO occurrence within the project area.

Effects Common to Alternatives 2 and 3

Direct and Indirect Effects

As noted above, there have been few detections of NSO in this area, all of which were in Subsection B, and during years of high dispersal with no positive indications of nesting within the area. Given the hot, dry, climate within the project area and reduced opportunities for an NSO to avoid high summertime temperatures and the associated heat stress, it is unlikely that habitat within the project area would be selected by NSO.

Forest vegetation data indicate that marginally suitable habitat occurs in Subsection B of the project area. As noted above, however, the NSO occurrence model developed for the 2011 Revised Recovery Plan and 2012 Critical Habitat rule indicates that the habitat is unsuitable (USDI Fish and Wildlife Service 2011, USDI Fish and Wildlife Service 2012a). Therefore, no direct effects would be expected from implementation of either action alternative. Disturbance requires an NSO to be present and, given the unlikelihood of occupancy of this area and with the proposed limited operating period (design feature WILD-1a), any disturbance or other adverse effects to NSO from project activities is discountable, or extremely unlikely to occur.

Some elements of currently potentially suitable habitat may be altered if understory components are removed by prescribed fire, which may result in some short term impacts to the forest structure. The predicted mostly low- to moderate-intensity prescribed fire would not reduce the functionality of any NSO habitat, and would maintain habitat function in the short term while improving the potential long-term suitability and resiliency. The proposed project activities would not remove or downgrade any NSO nesting/roosting or foraging habitat.

Given the size of the impacted area in relation to the amount and distribution of habitat favored by its primary prey species, the proposed treatments are unlikely to negatively impact any NSO that may occur in the analysis area through impacts to its prey. To ensure the distribution of NSO prey and that the overall availability of suitable habitat would not be significantly impacted by prescribed fire treatments, project design features limit the amount of potential NSO habitat included within proposed treatment units annually to < 50 percent of the suitable nesting/roosting and foraging habitat within a 7th field watershed.

In addition, the area within a fire perimeter that actually burns is highly variable[30] and unburned areas within the fire perimeter may act as refugia for some small mammals (Sugihara et al.2006). Therefore, the actual number of acres burned within any given treatment unit that may contain

NSO habitat is expected to be considerably less than the actual size of the treatment unit. Given this, along with the beneficial impacts to the ecosystem from fire, effects to NSO prey species distribution are expected to be discountable in the short term and potentially favorable in the long term.

Determination Summary

Based on the above analysis, the project wildlife biologist determined that implementation of the project within Subsection A will have no effect to the northern spotted owl because the habitat in this subsection is not suitable for the NSO and the species is unlikely to occur in the area. Implementation of the project within Subsection B may affect, but is not likely to adversely affect NSO.

Alternative 2 would be expected to have long-term beneficial effects to what habitat elements do occur in the analysis area as the forest becomes more fire resilient, fire return intervals more closely approximate historic patterns and fire is allowed to play a more natural role in ecosystem processes.

Cumulative Effects

Temporal bounding for this analysis is defined by both those actions that are in the reasonably foreseeable future (10 years) and by the total time of project implementation. This bounding captures both the potential disturbance during project implementation and the potential impacts to the habitat from the proposed project. The project area boundary served as spatial bounding for this cumulative effects analysis.

Baseline habitat conditions for the NSO in the analysis area are a product of a century of fire suppression and past wildfires and the effects have been included in the analysis of the NSO habitat environmental baseline for this project –Appendix A lists the past, current/ongoing and reasonably foreseeable future actions that provided context for the baseline conditions for the analysis area.

An additional federal action proposed within the Green-Horse analysis area has been initiated by the Bureau of Reclamation for the raising of the Shasta Lake dam 18.5 feet from above full pool. A spatial analysis of which areas would be affected by the inundation was completed for the Green-Horse project. From this analysis it was concluded that, in relation to the northern spotted owl and its habitat, very little impact is expected *within the Green-Horse analysis area*, as what little NSO habitat does exist in the analysis area is outside of the area affected by the inundation. This analysis was not conducted for areas outside of the Green-Horse analysis area.

There are 4,520 acres of private land inholdings within the Green-Horse project area boundary. A patch work of private land is also near and adjacent to the northern boundary of the project area. Because actions proposed for the Green-Horse project are not expected to have negative impacts to NSO there would be no overlap in space and time with actions on private lands to cause additive impacts to NSO or its habitat.

Survey and Manage Species

Surveys for species described as Survey and Manage under the Northwest Forest Plan were not performed for this project, as prescribed burning is indicated as exempt from required survey under “Pechman Exemptions”. In addition, habitat suitable for Survey and Manage species that occurs within the project area will have disturbance buffers and limited operating periods that will mitigate any potential for disturbance to individuals and habitats of Survey and Manage species that may occur in the project area.

Forest Service Sensitive Species

The recently updated 2013 Regional Forester's Sensitive Species list (a.k.a. Forest Service Sensitive Species) for the Shasta-Trinity National Forest addresses the following species:

Birds

Accipiter gentilis	northern goshawk
Empidonax traillii	willow flycatcher
Haliaeetus leucocephalus	bald eagle
Coturnicops noveboracensis	yellow rail

Mammals

Antrozous pallidus	pallid bat
Corynorhinus townsendii	Townsend's big-eared bat
Myotis thysanodes	fringed myotis
Gulo gulo luteus	California wolverine
Martes americana	American marten
Martes pennanti pacifica	Pacific fisher

Amphibians

Rhyacotriton variegatus	southern torrent salamander
Rana boylii	foothill yellow-legged frog
Rana cascadae	Cascade frog
Hydromantes shastae	Shasta salamander
Rana aurora	northern red-legged frog

Reptiles

Emys marmorata	northwestern pond turtle

Terrestrial Invertebrates

Monadenia troglodytes troglodytes	Shasta sideband snail
Monadenia troglodytes wintu	Wintu sideband snail
Trilobopsis roperi	Shasta chaparral snail
Trilobopsis tehamana	Tehama chaparral snail
Vespericola shasta	Shasta hesperian snail
Vespericola pressleyi	Big Bar hesperian snail

Insects

Bombus occidentalis	western bumble bee

Species that were excluded from further analysis because the project area is outside the ranges of or lacks suitable habitat for them include willow flycatcher, yellow rail, California wolverine, America marten, Cascade frog, northern red-legged frog, southern torrent salamander, Tehama chaparral snail and Big Bar hesperian snail.

Affected Environment

Bald Eagle

Bald eagle nesting territories are generally associated with lakes, reservoirs, rivers, or large streams. Nest trees are generally large-limbed, mature overstory conifers (generally pine) located within close proximity (2 miles or less) to large bodies of water that provide fish and water fowl for foraging.

Bald eagles have a very high fidelity to their established nests. A pair will remain in the same nest area year after year if left undisturbed. Around Shasta Lake, the nests are generally found in larger trees at a distance of 10 to 300 yards from the water's edge. Nests of adjacent territories are found at approximately 2 to 5-mile intervals, except for the Pit Arm of the lake where territories appear to be closer but are separated topographically from each other. This higher density of nests is believed to be the result of higher quality habitat in the Pit Arm of Shasta Lake. Most of the Pit Arm was not logged before construction of the dam and supports numerous snags, which provide foraging perches and better fish habitat than is found in the other arms of the lake (USDA Forest Service 1998). The Green-Horse project area contains some of the most productive eagle nesting habitat around Shasta Lake.

Bald eagles are present in the project area year-round, with both resident pairs and winter migrants. The number of known bald eagle nests on Shasta Lake has increased dramatically since record keeping began: from one known territory in 1970, 12 territories in 1980, 23 territories in 2009, and currently 35 territories in 2012, though not all are actively nesting on any given year.

The risk of habitat loss from high intensity wildfire is increased in the Shasta Lake area, and specifically the project area, particularly during periods of high recreational use, such as spring break, Memorial Day, Fourth of July and Labor Day vacations. During these periods, the increased risk of human caused fire, combined with high human use of areas in close proximity to eagle nest trees (i.e. the lake shoreline), puts the important eagle nesting habitat elements at very high risk of loss from high intensity wildfire. This risk is increased further where large accumulations of fuel are present in close proximity to current and potential future nest trees.

Shasta Salamander

The Shasta salamander has a very narrow range of distribution and is locally endemic to the Shasta County area and found primarily in areas near Shasta Lake though detections have been made recently in areas to the south and west of Shasta Lake (Naumann and Olsen 2004; Lindstrand et al. 2012). Most of its range is within the Shasta-Trinity-Whiskeytown National Recreation Area. The Shasta salamander has a discontinuous distribution within its range. It occurs in elevations ranging from approximately 730 to 3,475 feet; which reflects recent surveys done in 2012 that extended the known range of the Shasta salamander approximately 7.6 miles to the south and 10.7 miles to the west of its previously known range (Lindstrand et al. 2012, California Dept. of Fish and Game [CDFG] 2012). California Dept. of Fish and Game lists approximately 213 known locations primarily around Lake Shasta; Shasta-Trinity National Forest records show 47 occurrences within the Green-Horse project area – though these are not

necessarily different individuals and are likely recurring detections of many of the same individuals in different years.

The Shasta salamander exhibits an entirely terrestrial life cycle, is sensitive to temperature and moisture, and occurs in cool, moist micro-habitats (Olsen and Lewendal 1999). It primarily inhabits limestone formations in the Shasta Lake area and the slopes adjacent to these areas. A recent survey found that it may also inhabit non-limestone habitats near the McCloud Reservoir, though these occurrences are not common and are considered more of an anomaly. Microhabitats favored by this species include moist limestone fissures, caves, and rock outcroppings; in addition to underneath rocks, woody debris and duff in mixed pine-hardwood stands adjacent to moist caves, rock crevices and outcrops, and cliff faces.

A Forest survey protocol and management plan has been developed for this species. It is regularly surveyed for as part of the assessment process prior to ground disturbing activities. Primary threats listed in California Dept. of Fish and Game Non-game species assessments include increased recreation around Shasta Lake, limestone quarrying, and raising of lake water levels. In addition, timber harvest can cause a loss of habitat and possible direct mortality, due to moisture loss via canopy reduction and ground disturbance. Highways can act as barriers to dispersal, and rock quarries can remove or disrupt habitat.

Pacific Fisher

The West Coast Distinct Population Segment (DPS) of the Pacific fisher in California, Oregon and Washington was designated as Candidate in 2004 by the US Fish and Wildlife Service. It is also a Forest Service sensitive species.

Populations of fisher (*Martes pennanti*) currently occur in the North Coast Ranges of California and the Klamath-Siskiyou Mountains of northern California and southern Oregon. Additionally, surveys and sightings in California place fisher throughout much of the Sierra Nevada range. The Klamath region population, which includes the project area, may be the largest remaining in the western United States (Carroll et al. 1999).

The fisher is a forest carnivore that occupies late seral stage habitat in mature and old growth mixed conifer stands most often between 2,000 - 5,000 feet elevation, with a home range that can be very large (up to 11,000 acres in low quality habitat)(CDFG 2010). Fishers are generalized predators, and prey on small to medium sized mammals and birds. They will also eat carrion and fruits. In the western mountains, fishers prefer late successional forests (especially for resting and denning) and occur most frequently where these forests have the fewest non-forested openings (Powell and Zielinski 1994). Historically, trapping for fur reduced populations.

Drainage bottoms may be used more often for resting compared to ridge-tops and mid-slope locations possibly due to increased access to water, increased prey abundance, larger trees, and denser canopy cover (Yeager 2005). Riparian areas provide concentrations of rest site elements, such as broken-top trees, snags, and coarse woody debris. Whether for prey availability, water access, riparian vegetation or microhabitat conditions, Self and Kerns found fisher selectively used rest sites within 500’ of water, and rarely farther than 1,100’ from water (Self and Kerns 2001) .

Fishers tend to use large live trees with cavities, particularly oak species more often than logs for rest structures (Zielinski et al. 2004). Self also found that large (≥ 40”dbh), green trees (most frequently Douglas-fir with mistletoe brooms and/or forks) were used for rest sites 79 percent of

the time, while conifer snag cavities were used 15 percent, and logs used 6 percent of the time. Other studies have found that fisher will use cavities within hardwoods as preferred structure for denning (Seglund 1995).

The Shasta-Trinity LRMP Habitat Capability Models describe habitat guidelines for fisher as: late seral, older stands with snag density as 4-7 snags per acre >36"dbh and 2-4 of 24-36"dbh (high capability) or 2-4 snags/acre (moderate capability). Optimal cover for coarse woody debris is over 6 logs per acre or 2-6 logs per acre (moderate capability) (>10 feet long at highest available diameter) (USDA Forest Service 1995a).

Fishers are likely present in the project area because they are known to be present along the perimeter of the project area, and are therefore likely to occur within the bounding of the project area. Habitat suitability for fisher within the project area is variable depending on multiple habitat elements including canopy closure, stand composition, proximity to water, elevation, and abundance of large snags and downed logs.

California Department of Fish and Game Natural Diversity Database (CNDDB) lists two fisher sightings in the project area, both in 2004. The area surrounding Green Mountain was surveyed for forest carnivores in the late 1990s, though no fishers were detected. The area of proposed inundation under the reasonably foreseeable Bureau of Reclamation Shasta Dam and Reservoir project (see Appendix A) was surveyed in 2007, and fishers were detected in multiple areas around Shasta Lake, though none directly within the project area. CNDDB has at least 13 fisher detections throughout the Shasta Lake area, particularly west of the project area within the Sacramento River Arm of Shasta Lake.

The majority of fisher sightings in the Shasta Lake area have been near the shoreline of the lake. It is unknown if this is a function of observational bias and/or survey methodology or if there is a particular habitat component in these locations to attract fishers to these areas (i.e. water and/or prey), as the habitat around the lake is not typical fisher habitat that is found where other fisher sightings and known dens occur. Nevertheless, there have been multiple fisher detections surrounding Shasta Lake and throughout the Shasta Lake District and National Recreation Area.

Northern Goshawk

Northern goshawks can be found in middle and higher elevation mature coniferous forests; usually with little understory vegetation and flat or moderately sloping terrain. On the Shasta-Trinity National Forest, nesting habitat consists of relatively closed canopied, mid- and late-successional mixed conifer forest with scattered harvested and natural openings. Foraging habitat is variable and includes mid- and late-successional forest, natural and man-made openings, and forest edges (Woodbridge and Detrich 1994). Moderate and high quality habitats contain abundant large snags and large logs for prey habitat and plucking posts (Squires and Reynolds 1997). This habitat provides large trees for nesting, a closed canopy for protection and thermal cover, and open spaces allowing maneuverability below the canopy (Squires and Reynolds 1997). Goshawks are the largest North American accipiter and can consequently hunt a large variety of prey including woodpeckers, owls, tree squirrels, and grouse. In California, territories associated with large contiguous forest patches have been found to be more consistently occupied by nesting goshawks compared to highly fragmented stands (Squires and Reynolds 1997). Disturbance near nests can cause temporary displacement and/or nest abandonment (Squires and Reynolds 1997).

Goshawk habitat affiliations in northern California generally match those of the northern spotted owl (NSO) (Austen 1994, Zielinski et al. 2004, Yeager 2005, USDI Fish and Wildlife Service 2010). Therefore, NSO habitat was used as a proxy for goshawk habitat (see table 3-18 below). A small amount of marginal habitat, and even less high quality, late-successional habitat occurs in the northern portion of the project area, near and within the Madrone MLSA. If goshawks were to occur in the project area it would be within drainages and north facing slopes where there is a more moderate degree of slope.

Table 3-18. Goshawk habitat in the project area

Goshawk Habitat*	Project Area Acres
Late-successional (NSO nesting/roosting)	301
Mid-successional (NSO foraging)	1,011

The Forest Plan expects that habitat for goshawks will be provided through maintaining 100 to 200-acre territories for known goshawk nesting pairs, management of northern spotted owl habitat, riparian reserves, old growth reserves, dead/down and green tree retention with snag management.

Pallid Bat

Pallid bats are usually found in low to middle elevation habitats below 6,000 feet. A variety of habitats are used by this species, including grasslands, shrublands, oak woodlands, and coniferous forests, where it forages on a wide variety of insects and spiders. Pallid bats most often occur in open, dry habitats that contain rocky areas for roosting. They are a yearlong resident in most of their range and hibernate in winter near their summer roost.

Day roosts may vary but are commonly found in rock crevices, tree hollows, mines, caves, and a variety of human-made structures. Tree roosting has been documented in large conifer snags, inside basal hollows of redwoods and giant sequoias, and bole cavities in oaks (Pierson and Rainey 2007). Cavities in broken branches of black oak are very important and there is a strong association with black oak for roosting. Roosts have warm, stable temperatures and are generally high above the ground. Roost sites must protect bats from high temperatures, as the species is intolerant of roosts in excess of 104 degrees Fahrenheit (Pierson and Rainey 2007). Night roosts are usually more open sites and may include open buildings, porches, mines, caves, and under bridges. These are usually located within or near (less than 1.5 kilometers) foraging areas and within 2 kilometers of water (Pallid Bat Recovery Team [PBRT] 2008). Although year-to-year and night-to-night roost reuse is common, they may switch day roosts on a daily and seasonal basis (Sherwin 2005).

Winter habits are poorly known, but this species apparently does not migrate long distances between summer and winter sites. Sherwin (2005) found that in coastal California, males and females overwinter in a primary roost but occasionally use alternate roosts throughout the winter. Overwintering roosts have relatively cool, stable temperatures and are located in protected structures beneath the forest canopy, out of direct sunlight. In other parts of the species' range, males and females have been found hibernating alone or in small groups, wedged deeply into narrow fissures in mines, caves, and buildings.

Pallid bats are sensitive to disturbance and if they are persistently or severely disturbed, they will vacate roosts (PBRT 2008; Sherwin 2005). Disturbances at bat roosts can have severe

bioenergetic consequences for bats, particularly when disturbances occur at hibernacula (PBRT 2008; Sherwin 2005).

This bat species' tendency to roost in groups and their sensitivity to disturbance make them vulnerable to mass displacement. Roosts and hibernacula can be damaged or destroyed by vandalism, mine closures and reclamation, recreational rock climbing, and timber harvest (Sherwin 2005). Maternity colonies and hibernating bats are especially susceptible to disturbance. Loss or modification of foraging habitat due to fire, urban development, agricultural expansion, and/or pesticide use poses potential threats (Sherwin 2005). Populations have declined in California within desert areas, in areas of urban expansion, and where oak woodlands have been lost (Pierson and Rainey 2007).

Townsend's Big-Eared Bat

Townsend's big-eared bats are distributed broadly throughout western North America. They occur in two disjunct, isolated populations in the central and eastern United States. In the West, this species' range extends from the Pacific coast north to southern British Columbia, south to central and southern Mexico and the Baja Peninsula (Pierson and Rainey 2007). This species is found throughout California from low desert to mid-elevation montane habitats and has a particularly affinity for cavernous spaces such as mines, adits, caves, old buildings and bridges (Pierson and Rainey 2007).

Townsend's big-eared bat is a colonial species, with females aggregating in the spring at nursery sites, giving birth to one young in late spring or early summer. These nursery colonies, comprised of adult females and their young, remain intact until the young are independent in late summer or early fall. If undisturbed, colonies will use the same roosts indefinitely. Summer aggregations in California are presumed to be nursery colonies comprised only of adult females and their young. During the summer months, adult males are generally found roosting alone (Pierson and Rainey 2007; Gruver and Keinath 2006).

Unlike many species which take refuge in crevices, this species only roosts in the open, hanging from walls and ceilings fairly close to the ground, where it is relatively easily detected, which contributes significantly to its vulnerability to human disturbance (Pierson and Rainey 1997).

This species requires a relatively large, but enclosed space with a fairly substantial opening and area inside large enough to allow extended flight within the roost, but also somewhat enclosed and dark to semi-dark. They are also quite sedentary, with females not known to move more than a few kilometers from their natal roost and movement in the nursery season, either for foraging or shifting to an alternate roost, is confined to within 15 kilometers of the primary roost (Sherwin et al. 2000). Seasonal movements are also limited, with fall movement to hibernacula no more than 43 kilometers from summer roost sites (Sherwin et al. 2000).

Although historic and current records for this bat in California indicate the species occurs in a wide variety of habitats and in several life zones, its distribution appears to be constrained primarily by two factors: availability of suitable roosting sites and degree of human disturbance at roosts (Gruver and Keinath 2006; Sherwin et al. 2000).

There are a number of significant maternity and hibernating sites in both lava tubes and limestone caves in northern California, particularly in Shasta, Siskiyou and Trinity Counties. The Townsend's big-eared bat has been documented in the nearby Sacramento watershed and a roost is known to exist in a cave to the northeast of the Pit Arm watershed on the McCloud Ranger District. CNDDB records indicate two sightings of this species within the project area

within the watershed of the Pit Arm of Shasta Lake, near Susanville Canyon. Townsend's big-eared bats have also been observed in a cave near Potter Creek, within the project area (T. Johnson 2009 personal communication). Habitat in the form of limestone caves is available within the project area, and it is possible that Townsend's big-eared bat occupy the area.

Fringed Myotis

Fringed myotis (*Myotis thysanodes*) is predominantly a western bat species occurring from southern British Columbia, Canada, south through southern Mexico. It occurs west to the Pacific coast and east to the Rocky Mountains, with an isolated population in the Black Hills of South Dakota and Wyoming. They are generally found between 3,000 to 5,000 feet in elevation, though will occasionally occur in lower elevations near coastal areas. They occur within a broad range of vegetative types but are mostly commonly reported to occur in pinyon juniper, oak, ponderosa pine and mixed conifer forest types (Keinath 2004).

Due to their wide distribution and variety of habitats used, fringed myotis will use a wide variety of structures as roosts. In studies in northern California, male and female fringed myotis used snags exclusively for day roosts; and tend to select large snags that are taller relative to the surrounding canopy, within small openings surrounded by contiguously forested areas (Weller and Zabel 2001). Day roost trees are generally located in open microsites in otherwise contiguous forests, but not out in the open and are generally located nearer to stream channels (Weller and Zabel 2001). When an abundance of large snags are available in a preferred area, fringed myotis will readily switch roosts in the event of a roost collapse, for predator avoidance and to seek out more suitable microclimates (Lewis 1995, Weller and Zabel 2001). When necessary, fringed myotis have been known to switch roosts several times a week.

Fringed myotis will use caves, mines, abandoned buildings, bridges, and rock crevices as solitary day and night roosts, hibernacula and maternity roosts. Roosts in these more permanent and important structures elicit much higher roost fidelity as compared to more temporary roosts such as trees and snags, with strong site fidelity demonstrated at both the stand and roost scale (Lewis 1995, Weller and Zabel 2001). Maternal colonies, in particular, will show a high preference for specific roost caves and/or watering places, where they will return over the course of a summer and from one summer to the next (Keinath 2004, Lewis 1995).

Fringed myotis are morphologically adapted to forage in areas of relatively high vegetative clutter, such as interior forests and/or their edges, not wide openings such as clear-cuts or meadows, where their chief prey taxa (coleopterans) would be less abundant. Fringed myotis living in temperate forests (as opposed to desert dwellers) must drink water shortly after emerging from their day roost each evening, and may require up to half their body weight in water each day depending on the type of prey consumed (Christy and West 1993, Keinath 2004). Likely due to this aspect of their biology, they are generally found to roost in areas within close proximity to a water source, though the size and extent of that source can be highly variable.

Specific aspects of the life history of bats in general, and specifically fringed myotis, make them vulnerable to extirpation. An interagency expert evaluation panel considered the fringed bat to be more vulnerable to alteration of mature forest ecosystems than most bat species because it depends on old-growth conditions (i.e., forests with abundant, large snags suitable for roosting), is rare, occurs in a restricted elevation zone, and has strong site fidelity, in addition to increased sensitivity to roost disturbance, restrictive hibernation requirements, and low reproductive capacity (Forest Ecosystem Management Assessment Team FEMAT 1993, Keinath 2004, Christy and West 1993). Although their range is large, fringed myotis are rare and patchily distributed within that range and require a specific and restrictive combination of habitat characteristics (Keinath 2004).

It is a slight possibility that fringed myotis occur in the project area, as the important habitat elements are present in the area and this species has been found on the Shasta-Trinity National Forest, though only a rare occurrence (Pierson and Rainey 2007). Surveys have been done on the east side of the Forest, sampling for a wide variety of bats and this species was detected, though relatively rare as compared to other bat species captured. There are no records in CNDDB or NRIS for this species in the project area. During their telemetry studies and surveys of northern California, including many areas on the Shasta-Trinity NF, Pierson and Rainey (2007) concluded that fringed myotis were rare and but may occur in available rock crevices and caves, though one roost was found in a cat face of a large redwood tree (live). Of their nineteen study sites throughout a six county area, including Shasta County, fringed myotis was only detected in four sites and represented less than 1 percent of the total captures.

Terrestrial Mollusks

The Shasta chaparral, Shasta sideband, and Wintu sideband are all associated with limestone and/or talus rock outcroppings near Shasta Lake. The Shasta sideband and Wintu sideband are both strongly associated with the Pit Arm of Shasta Lake. Habitat for both species includes limestone areas, including caves, talus slopes, and other rocky areas adjacent to open, brushy areas, or pine-oak woodlands.

The Shasta chaparral is an endemic species of Shasta County. It is found within 100 yards of lightly to deeply shaded limestone rockslides, draws, or caves with a cover of shrubs or oak and is strongly associated with Shasta Lake.

The Shasta hesperian snail is endemic to the Klamath Province, primarily in the vicinity of Shasta Lake, up to 2,700 feet elevation. It has been found in moist areas, such as riparian zones, springs, seeps, marshes, and in the mouths of caves (Kelley et al. 1999; Duncan et al. 2003). It is associated with deciduous vegetation and woody debris in perennially moist areas.

Multiple protocol surveys have been conducted for these terrestrial mollusk species above and along Shasta Lake. There are multiple known locations of each of these mollusks in the Pit, Squaw and McCloud Arms of Shasta Lake within the project area.

Western Bumble Bee

Populations of western bumble bees (*Bombus occidentalis*) in states along the west coast of the U.S. have declined dramatically since the 1990's. Prior to 1998, the western bumble bee was both common and widespread throughout the western United States and western Canada. Since 1998, this bumble bee has undergone a drastic decline throughout some areas of its former range. While viable populations still exist in Alaska and east of the Cascades in the Canadian and U.S. Rocky Mountains, the once common populations of central California, Oregon, Washington and southern British Columbia have largely disappeared.

The recent dramatic decline of the western bumble bee in the west is speculated to be due to disease. Western bumble bees were reared in the same facility as other bumble bee species and became infected with pathogens to which they had previously never been exposed (Rao and Stephens 2007; Evans et al.2008; Thorp 2013 personal communication). It is currently speculated that commercial rearing and export of western bumble bees resulted in the unintentional transport of parasites and diseases, possibly causing its dramatic decline and potential extirpation from the west coast of the United States in very recent years (Rao and Stephens 2007).

Other threats to western bumble bees include habitat alteration/removal in the form of agricultural intensification, livestock grazing, urban development and landscape fragmentation,

which can reduce pollen and nectar sources and affect current and potential nest sites. Use of broad-spectrum herbicides can also reduce pollen and nectar sources. Additional threats to this species include invasive species, use of insecticides and climate change.

The impacts from these threats are exacerbated by the already extremely low numbers of the species in the wild. Dr. Robbin Thorp[31] has extensively searched several sites in southern Oregon (Mt. Ashland and Grants Pass vicinity) and northern California (Mt. Shasta vicinity) where western bumble bees were commonly found in the past. He has found only one individual since 2002 (Evans et al.2008). In yearly surveys of southern Oregon and northern California sites in which a total of 15,573 bumble bees were observed from 1998 to 2007, 102 individual western bumble bees were observed in 1998, nine in 1999, one in 2000, one in 2001, one in 2002, and none from 2003 to 2007 (Evans et al 2008). In 2008, a single specimen was captured on Mt. Ashland in Oregon in a survey that included over 2,000 bees that were caught in blue vane traps. An additional 2,000 bumble bees were examined foraging at flowers; no western bumble bees were observed. In 2007 over 20 specimens were collected in eastern Oregon, though they were quite rare, making up less than half of one percent of the relative abundance of all bumble bees collected in the survey; indicating that although present, this species is still extremely rare.

Western bumble bees are generalist foragers, feeding on pollen and nectar from a diverse array of plant species. As generalist foragers, they do not depend on any one flower type, though some plants rely specifically on bumble bees to achieve pollination (Xerces 2013). They are commonly found in riparian habitats, meadows and recently disturbed areas that contain abundant flowering plants. In studies in the Sierra Nevada, bumble bee abundance was found to be positively influenced by presence and proportion of meadow in the surrounding habitat, in addition to meadow wetness (Hatfield and LeBuhn 2007).

Western bumble bees primarily nest underground, typically in abandoned rodent nests located from six to eighteen inches below the surface (Thorp et al. 1983; Laverty and Harder 1988). Nests are often in abandoned rodent burrows, and less frequently in abandoned bird nests or open grassy areas (Evans et al. 2008, Koch et al. 2012, Xerces Society 2013).

The production of reproducing queens is dependent on access to sufficient quantities of pollen. The amount of pollen available to bumble bee colonies directly affects the number of queens that can be produced (Burns 2004 *as cited in* Evans et al.2008). Since queens are the only bumble bees capable of forming new colonies, pollen availability directly impacts future bumble bee population levels.

There are no known detections within in the project area, though the area is within the species' range[32]. While potential habitat exists in the project area, the likelihood that western bumble bees occupy the Green-Horse project area is low due to the increasingly rare distribution and abundance of the species. However, because the habitat in the project area is generally less fragmented and affected by current threats to bumble bees (i.e. urbanization, agriculture, pesticides, and exposure to commercially raised bees) it may be of a potentially higher quality

[31] UC Davis - bumble bee expert

[32] Due likely to the very recent addition of this species to the R5 Regional Forester's Sensitive Species List (July 2013), this species is not listed in CNDDB and past detections on the Shasta-Trinity have not been entered into the NRIS database; therefore, these standard information sources were not useful in this analysis. Through examination of research papers, district records, and personal communication with bumble bee expert Dr. Robbin Thorp (UC Davis), historic and current sightings and location information for this species was obtained for this analysis. Detection information was obtained from published bumble bee guides and research papers (Koch et al. 2012; Hatfield et al. 2012).

than other, more fragmented areas of the forest. In addition, livestock grazing does not occur in the project area, allowing for native flowering resources to grow, particularly in early seral and shrub habitat.

Riparian Associated Species

Riparian ecosystems generally occur as a transition zone between aquatic and upland ecosystems, and they include distinct and variable vegetation, soil and water characteristics. The associated plants and soils represent unique conditions that support a diversity of terrestrial and aquatic species and habitats. Because the following species are associated with riparian habitat, and therefore fall into a logical grouping, they will be discussed together below.

Northwestern pond turtles are associated with permanent or nearly permanent water from sea level to 6,000 feet in elevation. Western pond turtles (*Emys marmorata*) can be found in the United States from Washington to Baja, California, though the subspecies, the northwestern pond turtle, is only found in Washington through northern California, including some aquatic habitats on the Shasta-Trinity National Forest.

This species prefers quiet stretches of moving water on ponds, lakes, major rivers and streams. Important habitat elements such as partially submerged logs, rocks, mats of floating vegetation, or open mud banks, are used as basking sites and refuge from predators. Nest sites generally occur within 0.25 mile of water sources, and are usually characterized as open areas dominated by grasses and herbaceous annuals with a southern exposure (Holland 1991). Causes of population decline include habitat loss and alteration (both aquatic sites used for feeding and basking, and nest sites), population fragmentation, predation on young, especially by raccoons and introduced predators (e.g. bullfrog), and commercial harvest for the pet trade (Holte 1998).

Distribution and abundance of northwestern pond turtles on the Forest is not well known due to a lack of survey information. It is likely that this species occurs within the project area, as suitable habitat exists along creeks and lakeshore where important habitat elements such as downed logs and matted vegetation for the basking sites exist. Data records from the district and CNDDB include 7 anecdotal sightings within the project area, though no systematic structured surveys have been conducted.

Foothill yellow-legged frogs require relatively shallow, slow flowing water with only partial shading. Historic distributions of this species ranged through most Pacific drainages west of the Sierra/Cascade Crest, from southern Oregon to southern California. Current distribution and abundance of this species has been reduced drastically in the southern portion of its range but it still occurs throughout coastal drainages in the northern portion of its range. This species is closely associated with permanent bodies of still water and are typically found at elevations below 1,800 feet. Breeding occurs in the spring, in shallow, slow flowing water with pebble and cobble substrate, preferably with shaded riffles and pools. It is also known to occasionally use moderately vegetated backwaters, isolated pools, and slow moving rivers with mud substrates.

The foothill yellow-legged frog is at risk due to various anthropogenic and environmental threats throughout its range. Among some of the larger rivers in California, predation from introduced bullfrogs has been implicated as a cause of their decline. In addition, increased sediment loads in breeding streams have a potential to reduce survival of eggs.

No formal surveys have been conducted in the project area. Habitat for this species is present along intermittent and perennial streams. District records and CNDDB data indicate eight sightings along the Pit Arm of Shasta Lake within the perennial streams that feed into the lake.

Environmental Consequences

Alternative 1 No Action

Direct, Indirect and Cumulative Effects

With implementation of no action, and in the absence of disturbance, vegetation in the project area would continue to develop through natural succession. Increasing vegetation densities may hinder use of the project area by some species, such as northern goshawk and Pacific fisher, as travel would become more difficult.

Given the current fuel conditions and the high fire risk identified in the Wildfire and Fuels section above, a large high-severity wildland fire is likely to occur in the project area. As described in the Vegetation section above, and with ongoing and foreseeable fire suppression, there is a likelihood of high-severity vegetation fire effects to vegetation in the event of a future wildfire; see tables 3-4 and 3-12 above.

Of particular concern is the existing fuel condition surrounding known and potential bald eagle nest sites. If current fuel levels are allowed to persist, it is likely that in areas of high fuel conditions, large overstory conifers that support or could support nesting bald eagles would sustain extensive mortality in a high-intensity wildfire. These large trees juxtaposed along the lake's shorelines are a limited and finite resource that cannot be replaced in a practical timeframe; their loss would cause substantial adverse impacts to the eagles that rely on them as nesting structures.

Effects to bald eagles in the project area from loss of nesting habitat during a severe wildfire would be compounded by inundation of nesting habitat if the reasonably foreseeable Bureau of Reclamation proposal to raise Shasta Dam were implemented.

Alternative 2 – Proposed Action (Revised)

Direct and Indirect Effects

Bald Eagles: No direct effects are expected from the proposed activities because project design features would preclude disturbances during critical periods of bald eagle breeding season and when young are not mobile enough to readily move from a disturbance. In addition, because adult and fully fledged bald eagles are highly mobile, it is expected that when foraging or dispersing across the landscape during the non-reproductive season they can easily avoid smoke and activities that cause noise above ambient levels. A Limited Operating Period (LOP) from January 1 to July 31 would be implemented for all smoke-generating activities and all activities that would generate noise above ambient levels, within 0.25 mile of known nest sites.[33]

As of the end of 2013nesting season, there were eight eagle territories active within the Green-Horse analysis area.[34] Each of these territories would be evaluated for nesting status prior to project implementation, and an LOP would be assigned to those territories determined to be

[33] This LOP may be lifted after consultation with the district wildlife biologist based on site-specific assessment of individual bald eagle nest sites.

[34] Includes a 0.25 mile buffer surrounding the project area. Information on eagle nests was derived from the Shasta Lake district records from the 2012-13 eagle surveys. This is considered to be the most accurate bald eagle information for Shasta Lake due to their intensive survey efforts.

actively nesting. Additional nests may be discovered during subsequent surveys and LOPs would apply to these as well.

Impacts to habitat from wildfire can be highly variable and are dependent on multiple factors such as time of year, moisture level of the understory fuels, slope, aspect, wind, position on the slope, as well as other factors. Impacts to habitat may be seen most noticeably in how the forest canopy responds to fire. Concerns over impacts to habitat from fire generally center on whether the canopy survives relatively intact, though other concerns can also include the availability of large woody debris and snags and the amount of duff consumed by the fire (Smith et al. 2000; Webster and Halpern 2010).

Fire and Vegetation modeling for the project area estimated the predicted fire behavior during implementation of Alternative 2 (see tables 3-5 and 3-13 above). The modeling identified areas at a higher risk of crown fire (i.e. loss of overstory) and areas where the fire is more likely to burn with low intensity as a ground fire. No areas containing eagle nest zones were identified as at risk of active crown (i.e. a loss of overstory canopy) fire during implementation of the prescribed fire. Furthermore, the effects from treating the brush and fuels within these nest stands would be beneficial as the resulting stand would have a reduced risk of overstory loss (i.e. nest trees) from a future high-intensity wildfire.

Shasta Salamander: Shasta salamanders are found under restrictive microclimate conditions and are closely associated with limestone outcroppings and the ground cover types associated with this habitat, i.e. rocks and woody debris. Requiring a 300 foot buffer from limestone habitats for all activities that may directly or indirectly affect Shasta salamanders or their important habitat elements would avoid impacts to this species during project implementation.

In addition, Shasta salamanders in rock outcrops or limestone caves are typically active at the surface during periods of high moisture and will withdraw into subsurface refuges (i.e. crevices, beneath rocks or logs) when surface moisture abates (Lewendal 1995; Thelander and Crabtree 1994). These times of surface activity, are described within the Shasta salamander survey protocol as during wet weather systems with optimal temperatures from 38 to 41 degrees Fahrenheit and humidity within caves or outcrops of at least 90 percent and in adjacent habitats of at least 65 percent.

Burn prescriptions designed for the project would not include these weather and surface conditions. Periods where Shasta salamanders are *not* surface active are described within the survey protocol as ideal time periods for management activities because actions during times when the salamanders are not exposed to the surface would avoid direct impacts to salamanders.

Direct impacts to Shasta salamanders and impacts to habitat elements that may be used by the salamanders (such as downed logs, loose large rocks, etc.) would be avoided through implementation of Forest Plan Standards and Guides and design features WILD-3, WILD-4a and WILD-4b; dozer line and fuel reduction activities would not take place within limestone habitat or near cave entrances. Where fire line is necessitated near limestone areas, hand line would be constructed under the direction described in the design feature WILD-4a. Therefore, impacts from these activities are not anticipated.

Pacific fisher: Direct effects to fisher can include physical harm, death or the disruption of reproductive attempts that could occur during project implementation or near occupied habitat. Most of the proposed activities would occur along ridgetops where fire line would be constructed and prescribed fire would be ignited and allowed to back down the slope in a mosaic pattern.

However, fishers tend to avoid ridgetops and generally use the lower slopes and riparian corridors where no fire lines would be located and prescribed fire would burn at its lowest intensity, if at all (Zielinski et al. 2004; USDI Fish and Wildlife Service 2010).

It is therefore unlikely that this species would occur in areas where they would be unable to avoid impacts. In addition, adults of this species are highly mobile and capable of moving away from sources of disturbance. Therefore, they are unlikely to be directly impacted during the non-reproductive season during project implementation.

Parturition for fisher occurs between February and mid-April, and young are completely mobile and capable of normal locomotion by 10-12 weeks old, which would mean that any young that may occur in the project area would be old enough by July 10 (end of the limited operation period (LOP) for NSO habitat) to move away from a source of disturbance i.e. humans or fire (Ruggiero et al. 1994).

Because there is overlap between suitable northern spotted owl (NSO) nesting/roosting habitat and suitable denning habitat for fisher, it is likely that the LOP for NSO (February 1 to July 10) would help to avoid direct impacts to fisher during periods of reduced mobility.

The NSO LOP would help to avoid direct impacts to fisher during the reproductive period that may occur as a result of the proposed activities; however, because there is also potential denning habitat that is not affected by the LOP (areas not suitable for NSO) it is possible that impacts to individual fishers during the reproductive period may still occur if burning operations are implemented during periods of reduced mobility (i.e. spring).

Prescribed fire and its associated activities are not described as a threat to fisher population viability and are not expected to have adverse impacts to the species. The proposed activities would not affect or promote any of the threats to this species described by the US Fish and Wildlife Service – fragmentation or removal of key habitat elements (USDI Fish and Wildlife Service 2010). This alternative would have a beneficial impact by reducing the susceptibility of suitable habitat in the project area to loss from a future wildfire.

The proposed activities are also not likely to negatively impact currently intact suitable habitat because of the predicted fire behavior during project implementation (see table 3-5 above). Some elements of currently suitable habitat may be altered if understory components are removed by fire, which may result in some short term impacts to the forest structure. Understory vegetation would begin to recuperate the following season and likely return within approximately 10 years (Sugihara et al. 2006).

In addition, Forest Plan Standards and Guidelines would be met within the project area after project implementation, including guidelines for Riparian Reserves and snag/downed log levels. It is therefore unlikely that habitat for fisher would be negatively affected by treatments within these areas.

Northern goshawk: The probability is low that individual goshawks may be injured or killed during project implementation for several reasons. Goshawks are unlikely to occur in the areas that would be most affected by proposed activities, i.e. ridgelines and areas adjacent to ridges as this species nests on the lower slopes or bottoms of drainages and generally avoids ridges for foraging or nesting (Woodbridge and Detrich 1994; Squires and Reynolds 1997). Nests are highly unlikely to be located along ridges where disturbance from dozer line activity would occur, which would preclude disturbance to a nest on the off chance that one were to occur in the

project area. If a goshawk were present during either dozer line reconstruction or prescribed burning activities, adults are highly mobile and perfectly capable of maneuvering away from a disturbance.

Dozer line activity would generally occur along areas of pre-existing lines (i.e. with very little overstory), so no so indirect effects to overstory or nesting habitat would occur from re-opening these lines. Additionally, because of the predicted fire behavior during implementation of Alternative 2, negative impacts to goshawk habitat are not expected.

Reynolds and others emphasized the importance of developing and maintaining mosaics of vegetation patches in different successional states within goshawk home ranges in order to provide an abundant and diverse prey base as well as adequate nesting and foraging habitat for goshawks (Reynolds et al. 2006). Where habitat exists in the project area, it would be maintained within these parameters. Indirect effects may be beneficial, as habitat for goshawk prey species would be developed and maintained through the application of low intensity prescribed fire and a mosaic burning pattern within the understory. The proposed actions would not remove existing goshawk habitat and would likely benefit the condition of the small amount of current habitat.

Pallid Bat: Direct mortality could result from the loss of snags actively being used as roosts if they were to catch fire and fall during prescribed burning operations. If snags suitable for roosting fall, even if unoccupied, potential day roost habitat would be lost.

Parturition for pallid bats generally occurs in early July. However, pallid bats tend to use more permanent structures for roosting during reproductive periods, such as caves, rock crevices, bridges, and human made structures, and tend to only use trees as day roosts or feeding perches (PBRT 2008). Maternity roosts (when females and young are roosting together in larger groupings and are vulnerable to disturbance) are not likely to be impacted by proposed activities in part because prescribed burning would not be implemented during the summer months, as the hot, dry conditions would be outside of the burn prescription. In addition, caves and rock crevices used as roosts throughout the year would not be meaningfully impacted by the proposed activities, due to both the 250-foot protection buffer (design feature WILD-3) and because rocks and rocky outcroppings generally do not have adequate fuels to carry a fire.

Direct or indirect impacts to pallid bats may occur from proposed activities through disturbance to individuals roosting outside of caves or rock crevices, and potential loss of some roosting structures (i.e. snags or large trees). However, while incidental loss of snags or trees may occur (i.e. potential day roosts) if they were to catch fire during burning operations, low predicted flame lengths and crown fire potential during implementation (see table 3-5) would reduce this risk, so the risk of losing these structures would be reduced accordingly.

Caves and limestone outcroppings would be protected by project design features, so any roosting bats within these areas would not be affected. Dozer lines would be re-opened along lines that were previously constructed, and as such would be unlikely to contain suitable day roosting habitat such as large snags.

Disturbance in general from human activity in the area during prescribed burning activities has the potential to disrupt bat behavior if individuals were present in the area at the time, but they are highly mobile when not hibernating or within a maternal colony and can move away from a disturbance, especially of the type that is non-recurring and transient, as would be expected from the proposed activities.

While it is possible that impacts to individual pallid bats may occur if they are present in the area during implementation, it is unlikely that measurable and meaningful impacts to the species as a whole would occur.

Townsend's Big-Eared Bat: As described above, primary threats to Townsend's big-eared bats are a general lack of roosts and human disturbance to their roost sites, particularly during the reproductive or nursery period from spring to early summer (Pierson and Rainey 1997; Pierson and Rainey 2007; Gruver 2006; Sherwin et al. 2000). Project design feature WILD-3 would preclude any noise-generating or habitat modification activities within 250 feet of caves, mine shafts and mine adits to protect known or potential Townsend's big-eared bat and other bat species, roost sites. This design feature will not only protect this species from direct impacts in the form of human disturbance, but it will also ensure that the microclimate within the cave remains intact by retaining the vegetation at or near the opening of the potential roost site.

None of the important habitat features specific to Townsend's big-eared bats would be affected by implementation of the proposed activities under Alternative 2. Therefore, while there is potential for individuals to be directly or indirectly impacted from the proposed activities, measurable or meaningful impacts to the species are not expected.

Fringed Myotis: It is possible, though not probable, that fringed myotis occur in the project area, as this species is very rare and sparsely distributed within its range. A few smaller caves occur near the northern boundary of the project area and rock crevices exist throughout the project area. In addition, limestone outcroppings occur in several areas within the project area boundary, though these areas would not be directly impacted by the proposed treatments.

Large snags are also present in the project area that could be used as day roosts if located in the appropriate microclimate. It is possible that snags may catch fire during burning operations, though this is an uncommon occurrence when burning under the weather and fuel conditions prescribed for burning operations. Snags are not proposed for intentional felling unless they pose a threat to human safety during operations; therefore risk of loss due to direct felling is low. The transient nature of snags as day roosts for fringed myotis makes their loss less of an impact to the species, in part because of their overall abundance and also because they are much more easily replaced than more permanent and reproductively important structures such as caves, mines, and rock outcroppings.

Little is known about the use of burned forests by fringed myotis, or other bat species, but the inference is made that without the microclimates within the higher canopy closure and multi-layered forest vegetation preferred by this species, that they would no longer use the affected areas (Keinath 2004; Pierson and Rainey 2007). No roosts have been detected in areas of high or moderately burned forests, and this species is morphologically adapted to forage in high clutter environments within more densely forested areas than would be present post-fire. So, while prescribed fire has the potential to reduce the risk of loss of suitable forested habitat from high severity wildfire, it would also temporarily remove portions of vegetation that fringed myotis could use for foraging. However, a mosaic of burned and unburned vegetation is planned for each treatment unit. So, while some areas containing suitable habitat may be burned during project implementation, at no point would all of the available habitat be impacted and the bats could readily move to undisturbed areas as necessary. This, in combination with the low likelihood that this species would occur in the project area, greatly reduces the potential for effects to this species through impacts to its foraging habitat.

Research points to the survival of reproductive females as the key to population viability for the fringed myotis (Keinath 2004, Weller and Zabel 2001, Buchalski et al.2013). Disturbance

and/or destruction of the areas where they tend to congregate and have the most site fidelity (i.e. caves, mines, rock crevices and buildings) would have the greatest impact on the species as a whole. Because structures such as caves, mines, or buildings would not be removed or altered with the project activities, and if discovered in the project area, would be protected from disturbance (with LOPs) and habitat modification (with protection buffers), the disruption to key life history stages for fringed myotis, i.e. breeding and hibernating females, are avoided; therefore, population level impacts are not expected. Protective measures in place for other FS Sensitive bat, amphibian and terrestrial mollusk species would also serve to protect the most important habitat elements for fringed myotis.

Terrestrial Mollusks: These species are vulnerable to disturbance of their respective habitats. They are not highly mobile and would not be capable of avoiding disturbance. Proposed design features WILD-3, WILD-4a and WILD-4b were specifically created for this project to avoid impacts to these mollusks, and would preclude habitat modification within 250 feet of caves, mechanized equipment or pile construction within 300 feet of limestone rock outcroppings, or treatment within 100 feet of springs or perennial seeps.

With implementation of these design features, no measurable or meaningful impacts to the mollusk species listed above are expected, as suitable habitat would not be removed or altered, and direct disturbance would not occur during implementation of Alternative 2.

Western Bumble Bee: In the unlikely event that western bumble bees do use the project area, project activities may temporarily displace individual foraging bees during project implementation. This species is a generalist forager and not restricted to any one plant, and is therefore capable of utilizing a wide variety of flowering resources; such that if an area containing one type of flower (i.e. flowering *Ceanothus* spp.) is impacted during operations, this species can readily move to another area with other types of flowering vegetation.

Direct impacts could occur to underground nests if they were to occur directly within the areas used for dozer lines. Depending on the depth and level of compaction of soil along the intended dozer line, an unknown nest could be crushed if located close enough to the surface; nests located deeper into the ground may avoid being crushed. However, the likelihood of such a rare species not only occurring in the project area but also having its nest located exactly in the path of the intended dozer line at the exact time of implementation is extremely low.

Indirect effects to foraging habitat may occur during project implementation when flowering resources may be burned. Prescribed burning can temporarily reduce the abundance flowering plants in a specific area, particularly if done while they are flowering, but can also improve availability of this resource in the long term by causing increased nutrient availability in the soil and removing encroaching woody vegetation. However, if done too often or over an *entire* area of available flowering resources, effects can be detrimental to western bumble bees and pollinators in general. Recommendations for prescribed fire use in bumble bee conservation describe using low intensity fire, over no more than a third of the total area to be treated at a time, burning from October to February if possible, and leaving patches of unburned habitat to serve as refuge within burned areas (Hatfield et al.2012).

The Green-Horse project will potentially be accomplishing all of these recommendations, though the time of year may not always be from October to February; though because the project area is lower in elevation and can be accessed more readily in the winter, it is very possible that the recommended timeline is used. A mosaic of burned and unburned vegetation is planned for each

treated area. In addition, the vast majority of the available bumble bee habitat in the project area would be unaffected by the proposed activities, thereby allowing any bumble bees in treatment areas alternative areas to forage if disturbed. In addition, the proposed project does not include the use of pesticides or herbicides, so there will be no impacts to western bumble bees from their use.

Measurable or meaningful impacts to western bumble bees are not expected from project activities for the following reasons; 1) this species is unlikely to occur in project area due to its overall rarity, 2) this species is a generalist forager and not tied to any one species of plant and is therefore capable of transitioning to other flowering resources located away from project activities, 3) large areas of habitat would be left untreated, leaving food sources in areas adjacent to treated areas unaffected, 4) a mosaic of burned and unburned habitat will be present throughout the project area, and 5) no pesticides or herbicides will be used, thereby precluding impacts to bumble bees from their use.

Riparian Associated Species: Research has shown that in general, herpetofauna will seek refuge in wet or moist microhabitats when confronted with an advancing fire (Russell et al. 1999). Most impacts from proposed activities would occur upslope from the riparian areas, as prescribed fire would generally be backed down from the ridges.[35]

Current scientific literature indicates that low to moderate fire in general has little direct effect on most amphibians and reptiles, and that it can be presumed that animals associated with fire adapted vegetation are themselves at least behaviorally adapted to resist mortality by fire (Russell et al. 1999). If a turtle or frog was present and confronted with approaching fire it can be presumed that it would seek cover in the nearby moist areas or directly to the water. Direct effects may occur if the animal was unable to access these refugia, specifically turtles using upland areas to seek out nesting habitat; though, in general, it can be inferred that if the species is present in the area, then the appropriate moisture regime would also be present and subsequently offer refugia if needed. Prescribed fire is indicated as an appropriate management tool that can be used with other treatments to benefit herpetofauna, and other species that are associated with riparian habitats, by restoring a historical mosaic of successional stages, habitat structures, and plant species compositions. After extensive research on the effects of prescribed fire on herpetofauna, Russell concluded "although fire-induced disturbance may decrease herpetofaunal diversity within a particular patch, a mosaic of successional stages and habitat structures should increase diversity on a broader scale" (Russell et al. 1999).

While it is possible that small, isolated patches of riparian habitat may be incidentally impacted by fire, overall, the intention of the proposed activities is to restore a historical mosaic of successional stages, habitat structures, and plant species compositions to the riparian habitat while increasing the area's resiliency to wildfire. Additionally, the Aquatic Conservation Strategy would be applied to all aspects of project activities, and riparian habitats would retain their important habitat characteristics and remain intact.

In addition, no treatments would occur within 100 feet of any spring or seep (project design feature WILD-5). Therefore, no direct impacts to the species associated with these habitat types, such as the Shasta hesperian, are expected.

[35] Design feature RIPN-2 allows for fire to be ignited within Riparian Reserves under site specific conditions to achieve Aquatic Conservation Strategy objectives.

Cumulative Effects

Past wildfires and current or future actions (e.g. timber harvest on private lands, ongoing recreational activities, etc.) may exacerbate the human disturbance within the project area in the short term where they overlap in space and time with the proposed activities. However, the biggest agent of change that would have the most potential to cause additive impacts to many of the species described in the analysis would be the raising of Shasta Dam and the inundation of the land 18.5 feet above full pool surrounding the lake.

If Shasta Dam were raised by 18.5 feet (as is currently proposed), approximately 2,498 acres of land would be inundated (1,015 acres within the project boundary), which would result in the loss of a small amount potential habitat for more upland species such as northern goshawk, Townsend's big-eared bat, pallid bat, fringed myotis and western bumble bee, though extensive impacts to their preferred habitat from the inundation are unlikely.

While multiple detections of fisher have occurred along the perimeter of Shasta Lake in generally atypical habitat, it is unclear what aspect of that habitat they are using, so the effect of inundating those areas is unknown. It is possible that there will be minimal effects, as fishers are highly mobile and no denning has ever been recorded for these sightings within atypical habitat.

Raising the dam would have a greater effect on riparian-associated species such as foothill yellow-legged frogs and northwestern pond turtles. However, since these species are widespread, with both relatively abundant available habitat and a broader distribution, the impacts would still be relatively minor, though localized impacts to individuals in the inundated areas would cause habitat loss and potential mortality.

For the bald eagles that rely heavily on the habitat along the perimeter of Shasta Lake specifically, the impacts will likely be severe, but not likely to impact population viability due also to the broad distribution and relative abundance of habitat available elsewhere. However, localized impacts will be detrimental to individual bald eagle territories affected by inundation. Specifically, within the project area alone, 4 known bald eagle nests will be within the inundation zone; the Reno Canyon, Greens Creek, Flume Canyon, and Blue Canyon nests. Nest stands within this zone would be at least partially submerged and most likely die, displacing the bald eagles associated with these territories.

For local endemic species such as Shasta salamanders the impacts of this inundation may negatively affect populations occurring around Shasta Lake, though to what extent is not known. Of the potentially inundated lands, 114 acres are limestone, 27 acres of which is located within the project area. Shasta salamanders have an extremely narrow range of distribution and the majority of the known locations are within the limestone habitat surrounding Shasta Lake. While some individuals have been located outside this area, the vast majority are near or adjacent to Shasta Lake. Of the known Shasta salamander locations within the project area alone, approximately 7 known Shasta salamander sites are within the inundation zone in the event of an 18.5 foot high water increase; mostly notably, all of the known sites associated with the population at the mouth of Brock Creek; though suitable habitat exists at this site that would not be inundated This constitutes a removal of approximately 15 percent of the known occurrences within the project area and 5 percent of the known occurrences of this species (using the CDFG figure of approximately 213 known occurrences).

The same would occur for the terrestrial mollusk species associated with limestone (Shasta chaparral, Shasta sideband, and Wintu sideband). Shasta hesperian, while associated more with

springs and seeps rather than limestone, would also be negatively affected by inundation, as riparian habitat is also subject to loss through inundation. These species' lack of mobility makes them particularly vulnerable to habitat destruction or loss (which is why specific Project Design Features are indicated within the Green-Horse project to mitigate any potential disturbance during implementation). There are four known occurrences of FS Sensitive mollusks within the inundation zone within the Green-Horse project area (Shasta sideband and Wintu sideband). Undoubtedly, other occurrences will be inundated throughout the perimeter of Shasta Lake if the lake levels are raised, though exact numbers are unknown at this time. It can be reasonably assumed that an inundation to their occupied habitat would constitute a removal of that portion of the population.

Alternative 3 – No Forest Plan Amendment

Direct and Indirect Effects

Bald Eagle: No direct effects to eagles are expected from this alternative for the same reasons as described above for Alternative 2. However, not treating accumulated fuels within eagle nest stands would leave nesting habitat at risk from a future high-intensity wildfire.

Eagle nest stands in the project area are at high risk from overstory loss as they are highly exposed to human caused wildfire due to their close proximity to the edge of this popular, recreational lake – particularly during the hottest, driest periods when lake use is at its highest and fuel conditions are at their most volatile. As described above, the large overstory conifers juxtaposed along the shorelines are a limited and finite resource that cannot be replaced in a practical timeframe, and their loss would cause serious negative impacts to the eagles that rely on them as nesting structures.

Alternative 3 would, therefore, provide less long-term benefit to the eagle population at Shasta Lake. Effects of this alternative to eagle nesting habitat would be similar to those described for Alternative 1 (no action). The long-term effects of this alternative on bald eagles would likely be similar to those of Alternative 1 (no action) in the event of a future high-severity fire. If such a fire occurs in the portions of the project area not treated, the large conifers on which eagles depend may sustain extensive mortality.

Pacific Fisher: Indirect impacts from not treating suitable fisher habitat could result in the eventual loss of that habitat from high intensity wildfire. The exact amount of fisher habitat affected by this alternative is difficult to assess because we do not know the specific areas that may be used for activities such as denning or resting within the project area – and particularly because of their uncharacteristic use of areas near Shasta Lake that would otherwise be considered as unsuitable for fisher.

The Madrone MLSA would be treated under both action alternatives, so the more mature forested habitat described above that may provide potential denning habitat during the reproductive season would be treated. Therefore, the same potential for impacts during the reproductive season in these areas exists for both action alternatives. However, other areas outside of the MLSA that would not be treated under Alternative 3 may also provide denning habitat. A reduction in overall treatment acres would, therefore, result in a reduction in potential direct impacts.

However, in analyzing indirect effects of Alternative 3, we cannot establish all areas used by fishers that will go untreated with this alternative and subsequently provide an analysis of meaningful impacts to fisher from this lack of treatment. It can be assumed, based on the fire

and fuels modeling described above, that areas of suitable fisher habitat not treated prior to a high intensity wildfire event would be at high risk of loss during that event, so that impacts to fishers in the untreated areas would be similar to those described for Alternative 1 (no action).

Cumulative Effects

Cumulative effects from implementation of Alternative 3 may be somewhat reduced compared to Alternative 2, as the total acres affected by the proposed activities would be lower. However, in general, cumulative effects from Alternative 3 are the same as for Alternative 2 since the causes for potential cumulative effects are unchanged, i.e. the biggest agent of change (inundation of the lake perimeter under the proposed Bureau of Reclamation project) that would cause additive impacts remains the same. Differences in the total acres treated between the two action alternatives are not substantial enough to have a measurable or meaningful influence on the overall cumulative effects to most of the habitats and species described above.

Determination Summary

Shasta Salamander, Northern Goshawk, Pallid Bat, Townsend's Big-Eared Bat, Fringed Myotis, Terrestrial Mollusks, Western Bumble Bee and Riparian Associated Species: Impacts from Alternative 3 are not discernible from those of the Alternative 2, as this alternative would treat a subset of Alternative 2 and no other new areas would be affected by proposed activities.

While Alternative 3 would treat fewer acres, including fewer acres within limestone areas, the design features to protect species associated with this habitat type under Alternative 2 would also protect them under Alternative 3. Therefore, no measurable or meaningful impacts to the above listed species, and no impacts other than those described under Alternative 2 would be expected to occur under Alternative 3. Based on the above analysis, and with project design features as proposed in Chapter 2, the project wildlife biologist determined that both Alternatives 2 and 3 may impact individuals, but would not cause a trend toward federal listing or a loss of viability to all of the species addressed above.

Neotropical (Migratory Birds)[36]

Affected Environment

The Shasta-Trinity National Forest mostly lies in the US Fish and Wildlife Service Bird Conservation Region (BCR) 5 – Northern Pacific Rainforest. The following migratory bird species both occur on the Forest and are on the FWS list of birds of conservation concern for BCR 5:

Western Grebe	Bald Eagle	Northern Goshawk
Peregrine Falcon	Purple Finch	Black Swift
Rufous Hummingbird	Allen's Hummingbird	Olive-sided Flycatcher
Willow Flycatcher	Horned Lark	

[36] Effects to Federally-listed threatened or endangered birds were addressed in the project Biological Assessment (BA). Effects to Forest Service Sensitive birds and their habitats were addressed in the Biological Evaluation (BE). The Project Management Indicator Assembly (MIA) report analyzed project level effects to a select number of birds that represent Forest habitat assemblages.

Effects to the Forest Service Sensitive bald eagle, northern goshawk and willow flycatcher are addressed elsewhere in this section. The discussion of migratory birds that follows focuses on the effects of the alternatives on habitats within the project area that would be affected by the proposed activities including mature ponderosa pine, early seral conifer and brush, upper montane mixed chaparral, mid seral coniferous and oak forests, snags and downed logs.

Environmental Consequences

Alternative 1 – No Action

Because none of the proposed treatments would occur under this alternative, the habitat elements for migratory birds discussed below would not benefit from a reintroduction of fire to the landscape in a controlled manner. Under existing fuel conditions, a future wildfire is likely to burn with high severity, which could compromise mature ponderosa pine, early seral conifer and brush, upper montane mixed chaparral, mid seral coniferous and oak forests, snags and downed logs.

Effects Common to Both Action Alternatives

Early and mid seral coniferous and oak forest, upper montane chaparral and early seral brush habitats: To avoid high severity burning of the vegetation and loss of large areas of overstory or tree mortality, prescribed burning would begin on the ridge lines and be allowed to back down the slope in a low intensity, mosaic pattern. Bird species associated with early and mid seral coniferous forests were, therefore, considered during project design.

Snag and downed logs: Prescribed fire treatments were designed to retain downed logs of the largest diameter available of the largest sizes available and to not go below Forest Plan Standards for snags and downed logs. It is in this way that bird species that utilize cavities as either primary or secondary excavators were considered during project design.

Specific project design features that would benefit migratory landbirds and/or their associated habitats include WILD-1a through WILD-1c and WILD-2 (see Chapter 2 – Features Common to both action alternatives).

In summary, neither action alternative would adversely affect migratory landbird species that use the habitats described above as represented in the project area. Potential effects to migratory species would be minimized through project design, integrated design features and adherence to Forest Plan Standards and Guidelines such as those for snags and large down logs. The action alternatives were designed to improve habitat conditions in part by reversing vegetation trends that have resulted from a history of fire suppression.

Alternative 2 – Proposed Action (Revised)

Mature ponderosa pine: The proposed action was designed in part for the purpose of protecting, enhancing or maintaining wildlife habitat quality (see Chapter 1 – Purpose of and Need for Action). The purpose of and need for the project recognized that high fuel concentrations surrounding known bald eagle nest sites, if ignited by high-intensity fire, could imperil those sites.

To avoid high severity burning and loss of large overstory ponderosa pine trees, an important habitat element for nesting bald eagles, brush clearing treatments were designed for the most at-risk nest stands (and potential nest trees and perches). Bird species associated with large,

overstory ponderosa pine trees and snags – in particular bald eagles – were therefore considered during project design.

Alternative 3 – No Forest Plan Amendment

This alternative would eliminate treatment of mature ponderosa pines that serve as known bald eagle nest trees and/or potential nest and perch trees. The risks to this habitat for migratory birds under Alternative 3 would be similar to those described for Alternative 1 (no action).

Management Indicator Assemblages (MIA)

Management indicator assemblages (MIA) are groups of wildlife associated with vegetation communities or key habitat components, as identified in the Forest Plan[37]. The Forest Plan directs resource managers to monitor assemblage habitat trends at the National Forest scale (Forest-level). The Forest Plan permits the use of habitat components to represent the management indicator assemblages. The habitat components for late-seral, openings and early-seral, hardwood, riparian and chaparral assemblages are categorized in part using the California Wildlife Habitat Relationship (CWHR) System (CDFG 2008).

Affected Environment

A project-level analysis was conducted on the effects of the proposed activities on the habitat of each potentially affected management indicator assemblage, and described how these effects to habitat may influence Forest-level trends. Although population status and trend monitoring is not required by the Forest Plan, the Forest has selected appropriate representative species for several management assemblages and collects and/or compiles data regarding population status and trend for these species at the Forest level. Five habitat assemblages were determined to have the potential to be either directly or indirectly affected by the proposed activities. The assemblages are: Openings and Early Seral, Late Seral, Snag and Down Log, Hardwood and Chaparral. These assemblages are described in detail in the project Management Indicator Assemblage Report.

Population status is the current condition of the population measure for the representative species. Population trend is the direction of change in that population measure over time. Population data are compiled and discussed in Forest level monitoring reports, which are issued every 3 to 5 years.

Forest Trends in MIA habitat

Table 3-19 below provides a summary of the Forest trends in acres of management assemblage habitats based on data from 1994 to 2007 for all assemblage habitats addressed in this analysis except snags and down logs. Snags and logs are not part of this data set because they are not permanent features on the landscape and are habitat elements that can overlap other assemblage habitats.

[37]Shasta-Trinity NF Forest Plan, p. 3-24

Table 3-19. Amount in acres or percent of assemblage habitat on the Shasta-Trinity National Forest in 1994 and 2007

Assemblage	Amount of Assemblage Habitat in 1994 (acres)	Percent of Forest in Late-Seral Assemblage in 1994	Amount of Assemblage Habitat in 2007 (acres)	Percent of Forest in Late-Seral Assemblage in 2007
Late-Seral	785,000	36%	790,000	36%
Openings & Early-Seral	796,000	36%	801,000	36%
Hardwood	334,000	15%	323,000	15%
Riparian	1,500	0.07%	1,500	0.07%
Chaparral	58,000	3%	58,000	3%

Since 1994 snags have been recruited in large pulses by tree mortality from insect, disease, and fire on over 591,100 acres of National Forest System (NFS) lands in the Forest. Snags and logs are known to be deficient in plantations due to past management practices; therefore, there is a deficiency of snags on 67,700 acres of National Forest System lands. Snags and logs are not usually retained on private timber lands, so the snag and down log assemblage habitat is likely restricted to NFS lands. Table 3-20 below provides a summary of the acres within the snag and down log assemblage habitat since 1994.

Table 3-20. Acres of snag and down log assemblage habitat since 1994 and acres of snag deficiency due to plantations on the Shasta-Trinity National Forest

Assemblage	Total amount of assemblage contributed since 1994 (acres)	Gain due to wildfire since 1994 (acres)	Gain due to insect and disease since 1994 (acres)	Acres of Snag Deficiency
Snag and Down Log	591,100	177,300	413,800	67,700

Environmental Consequences

Alternative 1

Direct, Indirect and Cumulative Effects

Implementation of this alternative would have no direct effects to the MIA habitats and associated species. However, these habitats could be affected in the event of a future wildfire. Table 3-4 above describes the predicted fire effects to vegetation in the event of a wildfire under this alternative. Under the no action alternative, almost two-thirds of forested stands are predicted to experience high vegetation fire severity. Nearly all of the shrub and herbaceous vegetation communities are predicted to experience high or essentially complete levels of mortality following a wildfire.

Effects Common to Alternatives 2 and 3

Direct, Indirect and Cumulative Effects

The Vegetation section above describes in detail the predicted effects of prescribed fire on vegetation communities within the project area (see tables 3-13 and 3-15 above). Implementation of Alternatives 2 and 3 would reduce surface and ladder fuels while not markedly changing the dominant overstory in most areas. This reduction of fuel loading would

moderate future wildfire behavior for a period of time following prescribed burning. The effectiveness of fuels treatments, including prescribed fire, would be expected to last for approximately 10-20 years, analogous to one historic fire return interval common in much of the project area.

Conclusion

Currently, the project area consists of a wide variety of habitat types that are present in various seral stages within multiple vegetation types. None of these habitats would change assemblage under either action alternative. Low-intensity prescribed fire would affect each of the assemblages present in the treatment units without changing the assemblage type. Effects would be in the form of a reduction in duff and small- to medium-diameter woody debris; a reduction in older, decadent brush and brush skeletons, a reduction in the smaller trees and brush within the understory of mixed conifer stands; and possible opening of small pockets of overstory, though not to the extent that would alter the assemblage category.

Black-Tailed Deer and Black Bear

Within the Green-Horse project area, early-seral brush habitat on National Forest lands serves as browse for numerous species, such as black-tailed deer and black bear, in addition to prey species that support a wide variety of wildlife. These habitats provide cover and forage when in a well-maintained condition, with a mosaic of new growth for forage intermixed with older patches which serve as cover and potential fawning and bedding areas for deer, and forage and cover for black bear.

Affected Environment

Overall, coniferous and hardwood forest types occur over most of the project area with areas of brush and chaparral. According to the Pit Arm watershed assessment, approximately two thirds (67 percent) of existing chaparral in the watershed is over 60 years old, while other chaparral stands in the project area are 6 to 12 years old (USDA Forest Service 2010). Areas within the Green Mountain prescribed burning project have been burned multiple times over the last decade, and brushy areas have re-sprouted and contain new growth. Table 3-21 below describes the amount and proportion of browse/forage and brush species present in the project area for each Regional Dominance type pertinent to the discussion for black-tailed deer and black bear (see the Vegetation section above). Table 3-22 below displays the proposed treatment acres, by treatment type, under each action alternative.

The Vegetation section above describes in detail the effects of decades of fire suppression on the structure and composition of brush-dominated vegetation in the project area and how the resulting densification has led to increased decadence as observed by a preponderance of older woody growth with interspersed dead branches, very little new growth and accumulations of dead leaves and twigs on the ground.

Table 3-21. Deer and bear habitat as represented by browse, forage and brush cover species

Regional dominance type symbol	Alliance name	Acres	Percentage of project area
Hardwood Forest/Woodland			
QC	Canyon Live Oak	4,328	10%

Regional dominance type symbol	Alliance name	Acres	Percentage of project area
QK	Black Oak	8,117	19%
	Total Hardwood Forest/Woodland	**12,445**	**30%**
Shrubs and Chaparral			
CJ	Brewer Oak	245	1
CS	Scrub Oak	133	<1
CW	Whiteleaf Manzanita	225	1
CQ	Lower Montane Mixed Chaparral	3,390	8
CX	Upper Montane Mixed Chaparral	29	<1
	Total Shrubs and Chaparral	**4,022**	**10%**
Herbaceous			
HG	Annual Grasses and Forbs	13	<1
	Total Herbaceous	**13**	**<1%**

Table 3-22. Treatment acres in Wildlife Habitat Management prescription for each action alternative

Forest Plan Management Prescription	Prescribed Fire: broadcast burn or underburn (acres)	Hand Treatment: thin/prune/pile/burn piles (acres)	Dozer Lines (miles)
ALTERNATIVE 2			
Wildlife Habitat Management (VI)	5,778	21	0
All Management Prescriptions	41,625	208	4
ALTERNATIVE 3			
Wildlife Habitat Management (VI)	5,608	21	0
All Management Prescriptions	13,247	28	0

Black-tailed deer

The majority of the project area serves as winter range for the Columbian black-tailed deer, which migrate down from the surrounding higher elevations when snow begins to accumulate. Nearly all the land surface of the project area is below 3,000 feet elevation and normally is relatively free of snow. Important winter range is located on most of the south-facing slopes. The herds utilize the area as a migratory travel route from winter to summer ranges. Deer also utilize certain portions of the project area year-round, receiving the highest use when mast[38] crops are plentiful.

[38] Mast: the dry fruit from woody plants

Older, over-mature brush provides lower quality browse material for wildlife than younger more succulent brush. Old shrubs are lower in nutrition and often produce biomass that is out of reach of deer but may provide valuable hiding and thermal cover. However, too much woody cover suppresses the amount and diversity of valuable understory herbaceous forage.

The appropriate mix and age structure of forage species is important to quality deer habitat. Shrubs and woodland vegetation provide needed cover for deer and must be sufficiently abundant and distributed across the landscape in a way that provides adequate shelter from weather and predators (Sommer et al. 2007).

The shrub lands, hardwood stands, and hardwood/conifer mixed stands in the project area currently provide a moderate to high level of forage and cover for deer. In areas with previous fuels management (i.e. mastication and/or prescribed fire), browse condition is of higher quality than in untreated areas, where brush has become unpalatable due to decadence.[39] Fire exclusion has resulted in reduced palatability of browse for deer, while increasing the occurrence and future likelihood of large-scale high-severity fires.

Black bear

Black bears are common during all seasons within the project area and use a wide variety of habitats, with home ranges generally consisting of a relatively heterogeneous landscape. So, while brush fields with berry-producing shrubs, oak woodlands with mast producing trees, and mid-seral mixed conifer stands may compose a large portion of bear habitat within the project area, they do not contain all habitat requirements for bears. Habitats used by bears that are most likely to be affected by the proposed activities include early seral/brush fields and mid-seral mixed conifer stands because it is within these areas where the understory, brush skeletons and decadent shrubs comprise the heaviest fuel loading and are therefore most likely to burn.

As described above for deer, a mosaic of habitat types is also important for bears. Because bears will eat a wide variety of foods and choose these foods depending on the season, it is necessary to maintain this mosaic of forage, juxtaposed with suitable cover. Natural disturbance in an ecosystem can result in this variety of habitats in different vegetation successional stages and patterns.

Recommendations in the Pit Arm watershed analysis for species associated with early seral and oak woodlands include:

- “Implement fuels reduction projects such as prescribed burning to enhance early-seral and oak woodland habitat. To the extent practicable, protect existing large oaks from mortality during prescribed fires.”
- “Improve the quality and quantity of browse and oak woodland habitats for the persistence of game species.”

[39] Johnson 2009 personal communication

Environmental Consequences

Alternative 1 – No Action

Black-tailed deer

Under the Alternative 1 (no action), a lack of fire within the early seral brush and browse habitats in the project area would continue to reduce the amount of deer browse available in the understory in the form of mast, herbaceous growth or early seral shrubs/browse. Herbaceous growth would be outcompeted by the growth of shrubs and oak seedlings. Shrub species in the understory would mature and become less palatable as browse (USDA Forest Service 1998). This alternative would also allow the further encroachment of conifers into black oak stands and reduce mast production, and conversion of oak to conifer stands.

According to the California Mule Deer Habitat Management Guidelines (Sommer et al. 2007), a lack of fire, or other management actions that can mimic a fire-like disturbance, can contribute to:

- Reduction or loss of herbaceous plants as canopy cover increases.
- Decreased reproduction and abundance of plant species important for deer as the canopy structure changes.
- Increased plant susceptibility to disease and insect infestation as woody plants become decadent.
- Reduction or elimination of disturbances that cycle nutrients and maintain early and mid-successional habitats.
- Increased age, leading to decreased palatability, nutritional quality and availability of important browse species for deer.
- Monotypic communities of similar age and structure resulting in a lack of abundant and diverse high quality forage.
- Dense stands of vegetation reduce access to areas of higher quality forage.

The Wildfire and Fuels section addresses the high likelihood that future fires in the project area are likely to be widespread, with large areas experiencing active crown fire and high or very high flame lengths. While such fires may increase the availability of browse habitat, they can reduce the occurrence of effective cover for deer and other wildlife. Site quality and soil productivity, which directly affect the quality of browse habitat, are also at risk from future high-severity fires.

Black bear

As described above for black-tailed deer, exclusion of fire reduces the diversity and abundance of forage for black bears (Lyons et al. 2003). This condition would persist until a wildfire occurs in the project area.

Alternative 2 – Proposed Action (Revised)

Black-tailed deer

The use of well-planned prescribed fire and/or mechanical treatment in chaparral to create early successional, high-quality browse in close proximity to cover can provide substantial benefits to deer (Sommer et al. 2007). Table 3-23 below describes the benefits from prescribed burning, or low- to moderate-intensity natural fire, to deer and deer habitat as described within the California Mule Deer Habitat Management Guidelines. Changes in vegetation composition and structure after a fire influence how deer populations respond to post-fire landscapes.

Table 3-23. Benefits of prescribed burning or low to moderate intensity natural fire to deer and deer habitat (Sommer et al. 2007)

FOOD	✓ Improves nutrient cycling ✓ Increases nutrient value of plant species ✓ Increases palatability of forages ✓ Removes dense, rank, or over mature growth ✓ Stimulates crown or root sprouting ✓ Provides for early successional species and communities ✓ Reduces un-decomposed organic materials and litter that inhibit growth of grasses and forbs	✓ Creates a mosaic of different successional stages ✓ Encourages early spring green-up of grasses and forbs ✓ Eliminates undesirable plant species ✓ Stimulates seed germination
COVER	✓ Creates/maintains appropriate cover levels ✓ Produces temporary openings ✓ Creates edge ✓ Modifications of use patterns by deer ✓ Provides control of young invasive undesirable woody plants	✓ Improves detection of predators ✓ Improves fawning cover through the promotion of seed germination and growth of perennial bunchgrasses (fawning cover)
WATER	✓ Improves water yield ✓ Increases spring recharge	✓ Improves water infiltration, retention, and deep percolation (through increased ground cover)

The influence of fire in woodland chaparral on important deer habitat components is varied and is closely linked to quantity, quality, and diversity of food plants necessary for successful reproduction and survival of deer populations (Sommer et al. 2007). In mature or late seral stage chaparral communities, browse quality, quantity, availability, and diversity are primary limiting factors during much of the year (Biswell 1989, Sommer et al. 2007). A diverse mix of woody plants, forbs, and grasses in an early to intermediate seral stage provide deer with highly nutritious and palatable forage. Past research has shown that deer thrive on early successional vegetation that comes 1-10 years after a fire (Sommer et al. 2007).

Availability of diverse, high quality forage provides deer the opportunity to obtain year-round dietary requirements of protein, carbohydrates, crude fat, vitamins, and minerals. Fire can be an effective tool for returning early successional stages to fire adapted vegetative communities (Biswell 1989; Agee 1993; Sommer et al. 2007).

It is unknown whether deer are more disturbed by noise from heavy equipment versus sounds generated by humans during hand line construction. If heavy equipment does cause increased agitation, then the proposed line construction and reconstruction proposed under this alternative could cause temporary disturbance.

Black bear

Within treated areas, habitat for bears will improve as new growth of berry producing shrubs and increased ease of maneuverability result from treatments. Older, decadent brush and understory will be removed and replaced by new growth and a mosaic of openings juxtaposed with areas of cover.

Very little impact is expected from proposed treatments to other bear habitats such as riparian corridors, caves and rocky outcroppings, , where the general lack of fuel and/or the lack of proposed treatment will preclude any meaningful impacts to bear habitat. In drier vegetative

communities, such as the project area, riparian habitat is some of the most essential habitat for bears (Lyons et al. 2003) and very little impact to this habitat type is expected.

Because the mosaic of openings and cover is more important to black bears than individual habitat classes, maintenance of this mosaic is of the most benefit to bears (Lyons et al. 2003). This mosaic of vegetation can be maintained through prescribed burning, as proposed by this alternative.

Human disturbance in the area during project implementation may cause any bears occupying the area to be temporarily displaced to areas of less disturbance; though the magnitude of this disturbance is unlikely to be of any consequence as bears are highly mobile and tend to regularly distance themselves from most human disturbance regardless of the activity. The proposed dozer line construction and reconstruction may have the highest likelihood of temporarily disturbing bears that occur in the project area.

Alternative 3 – No Forest Plan Amendment

Total acres of prescribed burning and hand treatment are reduced in Alternative 3, as the Forest Plan amendment that would facilitate these actions would not be completed. Indirect impacts resulting from a lack of treatment to deer and bear habitat could result in the eventual loss of that habitat from a future high intensity-wildfire.

The exact amount of habitat affected by this alternative is difficult to assess because we do not know the specific areas used by individual deer and/or bear within the project area. In analyzing indirect effects of Alternative 3, we cannot establish all areas used by deer and bear that will go untreated with this alternative and subsequently provide an analysis of meaningful impacts from this lack of treatment. It can be assumed, based on the fire and fuels modeling described above, that areas of suitable habitat not treated prior to a high intensity wildfire event would be at high risk of loss during that event.

As described above, untreated acres of foraging habitat would continue to age more closer to senescence, thereby becoming less palatable and providing lower quality habitat than areas treated with prescribed fire. It would then follow that Alternative 3 would have fewer beneficial effects to deer and bear habitat in the project area than Alternative 2 because fewer acres would be treated.

Hydrology, Geology and Soils[40]

The cumulative effects analysis area for hydrology, geology and soils include the three 5th field watersheds (HUC5) that encompass the project area – Squaw Creek, Pit Arm Shasta Lake and McCloud Arm Shasta Lake. The time period for measuring cumulative effects is two-fold. Short-term effects are measured over the duration of project implementation – approximately 7 to 10 years. Long-term effects are measured over a period of up to 20 years following the completion of project activities, after which is the estimated duration of effectiveness of the proposed fuel treatments – or, in the event of selection of the no action Alternative, 20 years from the date of the Decision.

[40] The Hydrology, Soils and Geology section of this DEIS summarizes information contained in the Green-Horse Physical Science Report. The report is incorporated by reference and is part of the project planning record located at the Shasta Lake Ranger Station.

Affected Environment

Watershed

As noted above, the project area is located in three primary watersheds at the fifth level Hydrologic Unit Code (HUC5): Squaw Creek, Pit Arm Shasta Lake and McCloud Arm Shasta Lake; all are tributaries to the Sacramento River. The project area is further delineated into seven HUC6 sub-watersheds, which encompass a total of 16 HUC7 drainages and 51 HUC8 sub-drainages.

The Forest Service adopted a national process to systematically assess watershed condition. The Watershed Condition Framework (WCF) uses 12 core indicators based on multiple attributes to assess physical and biotic health at the sub-watershed (HUC6) scale. Indicators are grouped into four categories: Aquatic Physical, Aquatic Biological, Terrestrial Physical, and Terrestrial Biological. The findings from assessment of each indicator are compiled and assigned one of three condition classes, which are described in Forest Service Manual (FSM) 2521.1:[41]

- Class 1 = Functioning Properly –exhibiting high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition.
- Class 2 = Functioning at Risk – exhibiting moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition.
- Class 3 = Impaired Function – exhibiting low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition.

Six delineated sub-watersheds (HUC6) intersect the project area. The WCF assessments were completed by the Shasta-Trinity National Forest in 2011. The results of these assessments are displayed in table 3-24 below. Possible scores range from 1.0 – 3.0.

Table 3-24. Results of the Watershed Condition Framework assessment completed in 2011 for sub-watersheds (HUC6) in the Green-Horse project area

Watersheds (HUC5)	Sub Watersheds (HUC6)	Rating	Score	Indicators with Low Integrity
McCloud Arm Shasta Lake	Lower McCloud Arm Shasta Lake	At Risk	1.9	Water Quality, Water Quantity, Aquatic Biota, Aquatic Habitat, Soil Productivity
Squaw Creek	Upper Squaw Creek	Functioning	1.3	Roads & Trails, Fire Regime Condition Class, Forest Health
	Middle Squaw Creek	Functioning	1.3	Roads & Trails, Fire Regime Condition Class, Forest Health
	Lower Squaw Creek	At Risk	1.9	Water Quality, Water Quantity, Aquatic Biota, Aquatic Habitat, Soils
Pit Arm Shasta Lake	Lower Pit River	At Risk	1.7	Water Quality, Water Quantity, Aquatic Biota, Aquatic Habitat
	Potem Creek	Impaired	2.3	Water Quantity, Aquatic Habitat, Aquati Biota, Riparian Vegetation, Fire Regime Condition Class, Range Condition

[41] Categories as described– USDA Forest Service 2004

Watersheds (HUC5)	Sub Watersheds (HUC6)	Rating	Score	Indicators with Low Integrity
	South Side Shasta Lake	At Risk	1.9	Water Quality, Water Quantity, Aquatic Biota, Aquatic Habitat, Fire Condition Class, Terrestrial Invasives (Weed Spread), Range Condition

Hydrology

The most dominant hydrologic feature within the project area is Shasta Lake Reservoir, and it captures all runoff from the project area. Flow in the McCloud River and the Pit Arm is regulated upstream of the project area. Squaw Creek is free flowing upstream of Shasta Lake. The lower 30 miles of the Pit River constitute the longest of the five arms of Shasta Lake. The entire reach of the Pit River within the Pit Arm Watershed (HUC5) is inundated by Shasta Lake. The lower 12 miles of the McCloud River and lower 9 miles of Squaw Creek, both tributaries to the Pit Arm, are also inundated by Shasta Lake.

The McCloud River and Squaw Creek are underlain by bedrock that provides channel stability. To varying extent, the lower reaches of all tributaries to the McCloud Arm and the Pit Arm within the project area have been inundated by Shasta Lake. This is also the case for most tributaries to Lower Squaw Creek. All tributaries to the Pit Arm, McCloud River, and Squaw Creek drain terrain vegetated by brushy, understocked hardwood stands and ponderosa pine-dominated conifer stands.

The 2012 Bagley Complex, which occurred outside the Green-Horse project area, encompassed 69 percent of Upper Squaw Creek and 33 percent of Middle Squaw Creek Watersheds. Over 24 percent of the Upper Squaw Creek sub-watershed and 12 percent of the Middle Squaw Creek Sub-watershed experienced moderate or high burn severity. See figure 3-4 below.

Figure 3-4. On-site soil displacement as a result of high-intensity fire during the Bagley Fire (2012)

Soil sampling for water repellency was conducted as part of the Burned Area Emergency Assessment for the Bagley Fire. Sample results indicated a presence of 80 percent occurrence of water repellency in high-severity burn areas and 40 percent occurrence in moderate-severity burn

areas. Soil productivity was determined to be a value at risk. The high road density coupled with changes to hydrologic and geomorphic conditions from the fire has resulted in poorer watershed condition in the Upper and Middle Squaw Creek sub-watersheds.

Fire condition class for Potem Creek-Pit River and South Side Shasta Lake sub-watersheds was assessed as fair. The fair condition rating indicates that a predominant percentage of the sub-watershed has a departure from the fire regime. Current vegetation species and cover types are somewhat affected by the abnormal fire regime and provide less protection to soil and water resources when fire occurs (Watershed Condition Classification Technical Guide 2011).

As noted above, Potem Creek – Pit River is identified as impaired in the Watershed Condition Framework. Factors influencing this rating are water quantity, aquatic habitat, aquatic biota, riparian vegetation, fire condition class, and range condition.

Water Quality

Water quality in Shasta Lake is monitored by the Central Valley Regional Water Quality Control Board in cooperation with the Shasta-Trinity National Forest. No bodies of water within the McCloud Arm or Pit Arm Watersheds are currently on the Clean Water Act Sec. 303d impaired water body list; however, waters upstream of the Pit Arm Watershed are listed for temperature, dissolved oxygen and nutrients. Two tributaries in the Squaw Creek Watershed − Town and Horse Creeks − are listed as impaired for acid mine drainage. The source of the acid mine drainage is the abandoned Bully Hill and Rising Star Mines. Portions of the tailings and a debris dam are inundated when Shasta Lake is full. Localized water quality in Shasta Lake is also periodically impacted by the abandoned mines.

Beneficial uses in the three HUC5 watersheds that depend on high quality water include fish and aquatic life, domestic and municipal water supply, industrial and agricultural supply, hydropower generation, water contact and non-contact recreation, aesthetic enjoyment, freshwater habitat, fish spawning, wildlife habitat, riparian vegetation, and preservation and enhancement of fish, wildlife, and other aquatic resources (Central Valley Regional Water Quality Control Board [CVRWQCB] 2011).

Water quality parameters that are most relevant to the action alternatives are sediment (turbidity, dissolved solids, suspended sediment), water temperature and chemical constituents, including nitrogen, phosphorus, calcium, magnesium and potassium.

Several large precipitation events occurred in the late fall of 2012 following the Bagley Fire. Local Forest Service hydrologist Steve Bachmann reported that he had never seen so much turbidity following a fire as in Squaw Creek (Bachmann 2013 personal communication). The amount of sediment moving the creek was consistently high, even between storms. Several feet of sediment were deposited on both banks of the creek throughout the analysis area following these post-fire storms (Bachmann 2013 personal communication). See figure 3-5 on the following page.

Riparian Reserves

Riparian Reserves consist almost exclusively of stream channels, unstable areas and reservoir buffers. A total of 17, 346 acres of Riparian Reserves occur within the project area, of which 15,605 acres occur on public lands. The Riparian Reserves comprise approximately 37 percent of the land base in the project area. On perennial and intermittent streams obligate riparian vegetation is often present, decreasing further from the edge of the stream as elevation increases

above the water level. Riparian Reserves provide many functions to the stream channel network—regardless of vegetation changes from adjacent uplands—that include hydrologic connectivity, nutrient transport, filtering of sediment, wildlife movement and habitat.

The Shasta Lake shoreline has upland vegetation except where the shoreline intersects a stream channel. Lake level varies by tens of feet seasonally – and in response to dry and wet climate cycles averaging about a 60 foot change annually – leaving barren, exposed shoreline that is subject to wind and wave action during low lake levels. Erosion occurs along the shoreline and contributes to high turbidity in Shasta Lake.

Figure 3-5. Sediment delivery in Squaw Creek as a result of erosion from the Bagley Fire (2012)

Riparian areas typically burn with frequencies and intensities similar to that of the surrounding forest. The topography of many of the low order channels with steeper gradients can actually funnel winds, thereby increasing the localized intensity of fire and resulting in higher consumption of vegetation and ground cover along the channels. Alternative 2 proposes treatment of over 15,600 acres within Riparian Reserves, or approximately 37 percent of the proposed treatment acres. Alternative 3 proposes treatment of 4,955 acres within Riparian Reserves (also approximately 37 percent of the proposed treatment acres). The current fuel loading in Riparian Reserves is similar to that on adjacent hillslopes. Riparian Reserves are included in the proposed treatment areas because, if left untreated, they would carry higher fuel loading than adjacent hillslopes. If a wildfire were to occur under such conditions, fire behavior in the Riparian Reserves would likely be extreme.

ERA Model

The results of the ERA model analysis indicate that the McCloud Arm, Pit Arm, and Squaw Creek Watersheds (HUC5) are below the threshold of concern for cumulative watershed effects

with a low disturbance level. Analysis of the 7th field watersheds (HUC7) indicates that all 16 drainages are below the threshold of concern with a low disturbance level.

Analysis of the 8th field sub-drainages (HUC8) indicates that disturbance levels range from low to moderate. A total of 51 sub-drainages were analyzed with the ERA model. Three sub-drainages scored moderate disturbances levels, and the remaining 48 indicated low disturbance levels. Two of the sub-drainages within the Ski Island-Pit Arm Shasta Lake and the Bailey Cove-McCloud Arm Shasta Lake Drainages, respectively, are at the low range of the moderate scale. One sub-drainage within the Clikapudi Creek-Pit Arm Shasta Lake drainage approaches a high disturbance level. Table 3-25 below describes the characteristics of the Low, Moderate, High and Very High disturbance level ratings of the ERA model.

Geology

Bedrock and Structure

The project area lies within the Redding terrane, also known as the Eastern Klamath terrane. The Eastern Klamath terrane is the southernmost terrane of Eastern Klamath Belt within the Klamath Mountains Province. The Redding terrane contains the oldest rocks of the Klamath Mountains ranges (dating from the Cambrian to Triassic periods). Rocks within this terrane are thought to match the Sierra Nevada terrane.

The Forest Service bedrock layer maps eleven formations of the Eastern Klamaths that range from the Jurassic through the Permian period. Within the project area, rocks become progressively younger from west to east. The mapped formations include Arvison, Modin, Brock Shale, Hosselkus Limestone, Pit, Bully Hill Rhyolite, Dekkas Andesite, Nosoni, McCloud Limestone, and Baird.

Several granitic Mesozoic pluton intrusions exist within the project area, most notably along the east shore of the McCloud Arm adjacent to the Baird Formation and McCloud Limestone. Surface lithology is predominantly metasedimentary, metavolcanic, and volcaniclastic, but is a mélange of many lithologies. No naturally-occurring asbestos (NOA) is known to exist in the project area. The McCloud Limestone and the Hosselkus Limestone Formations are unique – and consequently highly valued – portions of the landscape.

The Klamath Mountains have been subjected to long periods of uplift, which continue to the present. The uplift process – along with the presence of weak rock units typical of accreted terranes and substantial precipitation events – has created a steep rugged landscape sculpted in large part by landsliding (primarily debris slides). Large, deep-seated landslides are uncommon relative to other watersheds within the Klamath Mountains. Fluvial erosion and mass wasting dominate geomorphologic processes in the project area.

Sensitive areas (areas prone to landslides) include inner gorges and seeps adjacent to draws. Drainages with mapped slides, both dormant and recent, include Bailey Cove – McCloud Arm, Hirz Bay – McCloud Arm, and Bully Hill – Squaw Creek. Active slides are present in Town Creek, First Creek, and Second Creek within the Bully Hill – Squaw Creek Drainage. Debris flows occurred on Winnibulli Creek and in the North Fork of Salt Creek drainage during the 1997 flood.

Soil

Soils are biodynamic bodies of mineral matter, organic materials, micro-fauna, vegetation, and air. The combination of these components makes up the soil ecosystem. The soil ecosystem

consists of above- and below-ground components. The above-ground component is the forest floor that consists of coarse woody debris, organic matter, litter, and duff mat. The below-ground component is mineral soil that consists of mineral materials, organic matter, and pore space. Biological activities occur in the forest floor and within the soil. Natural and human-caused disturbances may impact both the above- and below-ground components. Analysis of proposed management activities must consider impacts to both above- and below-ground components.

Soil mapping for most of the project area was performed primarily at the Third Order, delineations are as small as 10 acres for highly contrasting soils, while on non-contrasting soils delineations are as small as 40 acres (USDA Forest Service 1994). Soils in the project area are predominantly mapped as metasedimentary or metavolcanic, although inclusions of soils with granitic, volcanic and sedimentary parent material are present throughout the project area.

Soil textures generally range from fine-loamy to loamy skeletal. Roughly a third of the soils are mapped as fine-loamy and two-thirds are mapped as loamy skeletal. Soil depth varies from very shallow to deep. Limestone and metamorphic rock outcrops are also mapped as units in the soil survey. These rock outcrops have little or no evidence of soil profile development. Table 4-5 displays the soil families and key properties found within the project area.

Hydrologic soils groups are used to estimate runoff from precipitation. Soils are grouped according to the intake of water when they are thoroughly wet and receive precipitation from long-duration storms. Soils in the project area are generally well-drained. Soils with a higher runoff potential in the area are shallow, poorly-developed and underlain by bedrock. Sixty-seven percent of the soils are mapped with a moderately low runoff potential.

Erosion hazard is a relative measure of soil sensitivity to erosion processes. Many interrelated factors are evaluated in an Erosion Hazard Rating (EHR) to determine the likelihood that land use activities would cause accelerated erosion, and to what degree accelerated erosion would cause adverse effects. Soil disturbance has the potential to increase erosion hazard because soil cover is generally reduced by the disturbance. Calculated maximum erosion hazard ratings (EHR), which rate soil erodibility for 100 percent bare soil, are predominantly moderate to high. Moderate ratings mean that accelerated erosion is likely to occur in most years and water quality impacts may occur. High ratings mean that accelerated erosion will occur in most years and adverse effects on soil productivity and nearby water quality are likely to occur.

Maintenance of soil cover will reduce the erosion hazard. For soil families listed in Table 4-5 (Deadwood, Goulding, Holland, Marpa and Neuns), the EHR increases as slope steepness increases. The Marpa and Holland soil families occur on slopes varying from 20-80 percent. Hillsides with slopes less than 40 percent have a low maximum EHR, whereas hillsides with 60-80 percent slopes have a very high maximum (little or no vegetative cover) EHR. The calculations for post treatment conditions assume a temporary soil cover of 50 percent. Post-treatment of EHR of the Marpa and Holland soils ranges from moderate to high on the steepest slopes. The Chaix family soil is a granitic soil with forest standards and guidelines of 90 percent cover. The only mapped occurrence of the Chaix family soil in the project area is within the 1802000312030204 Sub-drainage (HUC8) and Ski Island Pit Arm Shasta Lake Drainage (HUC7).

Burn damage susceptibility is assessed for environmental analysis and project planning. The risk of damage to the soil from fire increases proportionately with the intensity of heat. Damage is mainly related to the loss of organic matter, although some soils have characteristics that enable

them to withstand this loss better than other soils (Miles 1999). Heat from fire can also damage soils through breakdown of soil structure, development of water repellency layers, loss of nutrients, and changes or loss of microbial species. Approximately 25 percent of the soils within the project have moderate susceptibility and 60 percent have high susceptibility to burn damage.

The terrain in the project area is rugged, and hillsides range from moderately steep to very steep. Only three percent of the area is gently sloped. Large portions of the drainages remain unroaded, and their hillslopes are not well-suited for heavy ground equipment. Susceptibility to erosion and sediment delivery to the stream network increase with increasing slope. Particularly on steep slopes, ground cover is critical to keeping soil in place and preventing soil runoff from reaching the stream network.

The Shasta-Trinity Forest Plan provides guidance for protecting soil productivity through managing surface organic material. Under general forest large woody material, when occurring in forested areas, is at least 5 logs per acre in contact with the soil surface. The Forest Plan requires an average of 20 tons per acre of unburned dead/down material[42] for Management Prescription II (Limited Roaded Motorized) (USDA Forest Service 1995a, p. 4-47). Management direction for Management Prescription III (Roaded Recreation) is to provide an average of 10 tons of unburned dead/down material per acre on slopes less than 40 percent and where feasible, the same amount on slopes over 40 percent (Forest Plan, pages 4-65 to 4-66). Other management direction includes maintaining dead/down material at naturally occurring levels.

Soil scientists agree that surface organic matter should be maintained at levels that sustain soil productivity and that do not elevate wildfire risk and severity – and the resulting detrimental effects to soils. In dry environments biological decay is limited, which allows accumulation of dead and downed material. Fire suppression that alters the natural fire regime can allow these layers to accumulate at levels uncharacteristic of normal conditions. In forested areas, needle shed from long needle pines can suppress naturally occurring vegetation such as grass and forbs.

Fire plays an important role in recycling nutrients in the debris. However, increased fire intensity quickly reduces available nitrogen in soil (Bormann et al. 2008). Localized site conditions present two issues with the current standards for dead and down material in these management prescription areas. In the majority of these administrative areas the standards are currently not met and are highly unlikely to be met, even without fuels treatments. Treating dead and down material to reduce fire risk and fire hazard would further trend these areas away from the Forest Plan dead/down material standards. However, in these areas, as well as in areas where these Forest Plan standards are met, current fuel conditions pose a risk of detrimental effects to soils in the event of a wildfire.

In more productive dry forests coarse woody debris (CWD) may range from 5 to 20 tons/acre while a ponderosa pine forest in Arizona the CWD may range from 5 to 10 tons/acre (Graham et al. 2010). In areas dominated by brush and oak vegetation the potential for dead and downed material declines.

[42] Dead/down material includes fine organic matter and large woody material (often referred to as “coarse woody debris”).

Environmental Consequences

Alternative 1 – No Action

Under the no action alternative, no fuels treatments would occur in the project area. Current fuel conditions would not be addressed. The project fuels specialist concluded that, under this alternative, fuels would be expected to continue to accumulate and contribute to increased fire behavior, intensity and severity of effects of future wildfires.

Direct Effects

The no action alternative would have no direct effects on watershed or hydrologic function, soils or geology within the project area.

Indirect Effects

The potential for future fire behavior to exceed most ground suppression capabilities under this alternative is high, with approximately 70 percent of the landscape producing flame lengths greater than 8 feet. Mortality and canopy loss, as portrayed by crown fire potential, is expected to approach 70 percent as well. See the project Fire, Fuels and Vegetation Report for more detailed information.

Watershed/Hydrology

Although a high-severity fire is not certain to occur within the project area during a given timeframe, the occurrence of such a fire would increase the potential for impacts to hydrologic systems in severely-burned watersheds. Increased volume of sediment delivered to the stream network would occur. Increased sediment delivery would in turn likely increase turbidity.

Increased sediment delivery from surface erosion would likely peak the first year after the event and then recover gradually over the next 6 – 10 years. Sediment delivery from mass wasting would persist for longer periods until stabilizing vegetation could recover. Increased sediment delivery to channels is a concern with regard to surface waters because the antidegradation provisions of the Clean Water Act (CWA) and Basin Plan prohibit an "increase in pollution." In other words, high quality waters must be maintained as such. Additional water quality objectives that could be impacted by a large high severity fire include pH, nitrogen, phosphorous, sulfur, calcium, and other minerals mobilized by wildfire.

Increased stream temperature resulting from reduced shade is also a concern if high-intensity, stand-replacing wildfire occurs within Riparian Reserves. These highly productive areas can develop heavy fuel loads capable of supporting stand-replacing crown fires, which can alter wildlife habitat and ecosystem function and contribute to channel erosion (Van de Water and North 2010). Wildfires within Riparian Reserves typically experience a similar burn severity to the adjacent hillslopes in a large wildfire.

Changes in site evapotranspiration demands, interception of precipitation by vegetation, and reduced soil infiltration would result in increased runoff, decreased lag time and increased peak flows. Higher peak flows would raise the likelihood of increased channel and bank scour as well as ash and debris flows. Streambank and bed stability would likely decrease if stabilizing bank vegetation and coarse woody debris were also reduced by high-severity fire.

Cumulative Effects

Cumulative Watershed Effects

Wildfire will almost certainly occur within the project area during the next three decades. Monitoring of post-wildfire conditions in pre-treated and untreated vegetation with long-term suppression management indicates that areas in untreated vegetation experience much higher-severity fires. The severity and size of those fires would determine the cumulative watershed effects of the no action alternative.

Fire modeling at the 90th percentile (see the Wildfire and Fuels section above) found that the potential for fire behavior to exceed most ground suppression capabilities under this alternative is high, with approximately 70 percent of the landscape producing flame lengths greater than 8 feet. Mortality and canopy loss, as portrayed by crown fire potential, are expected to approach 70 percent as well. Changed conditions from many decades of fire suppression and a continuing policy of fire suppression increase the risk of high-severity fire under the no action alternative. Fire modeling produced scenarios that would result in increased surface erosion, mass wasting, and percent ERA.

Geology

Although a high-severity fire is not certain to occur within the project area during a given timeframe, the occurrence of such a fire would increase the potential for mass wasting events above natural background levels. Increases in mass wasting would result in increased sediment delivery to the stream network with potential to impact downstream resources. Increases in mass wasting could impact channel morphology by increased scour and deposition from debris flows.

Accelerated sedimentation could also adversely affect cave resources because cave entrances are often situated along stream channels. Rapid in-filling of a cave could eliminate unique wildlife habitat that occurs there.

Soil

Implementation of the no action alternative would allow developing litter layers to mature. Untreated, self-thinning stands would continue to contribute woody debris to the forest floor, allowing decomposition to continue and adding needed organics and soil wood to the soil profile. On many sites, woody debris accumulation would outpace decomposition, allowing surface fuels to increase over time.

Wildfire is a natural and cyclical component of the project area's ecosystem that manages fuel accumulation. Fuel reduction treatments other than prescribed fire for the project area are not feasible because of the administrative designation of inventoried roadless as well as lack of accessibility to the remote and rugged terrain. Large wildfires resulting in moderate to high severity have occurred during the last three decades in close proximity to the project area: these include the Bear, Fountain and Jones Fires and the 2012 Salt and Bagley Fires. For a more detailed description of the area's fire history refer to the project Fire, Fuels Air Quality and Vegetation Report.

Long-term suppression of wildfire within the project area has resulted in fuel conditions that could produce large high-severity wildfire. In the absence of fuels treatment, the risk of future large high-intensity fires would continue to increase as additional fuels accumulate and understory vegetation develops, thus increasing surface and ladder fuels that contribute to fire spread and increase the risk of crown fire.

The occurrence of a high-intensity wildfire would increase the potential for impacts to soils and soil productivity in severely burned areas, especially because the risk of soil erosion increases proportionally with fire intensity (Berg and Azuma 2010, Neary et al. 1999). Loss of soil cover would significantly increase erosion, thereby reducing soil productivity and increasing the risk of water quality degradation from sediment. Other potential detrimental effects could include the potential loss of organics, loss of nutrients, and a reduction of water infiltration.

Between November 20th, 2012 and December 5th, 2012, three large storms impacted the Bagley Fire area, precipitating 26 inches of rain (equivalent to a 50 year storm event followed by two 25 year storm events). Extensive gullying and multiple debris flows and road failures were documented after the storms (see figure 3-3 above). The magnitude of erosion directly correlates to fire severity. Emergency road protection treatments were poorly to moderately effective in moderate-severity burn areas and seriously compromised in high-severity burn areas (Bagley Fire BAER Storm Monitoring Report 2013). Fire storm damage in low burn severity consisted of sheet and rill erosion. Moderate burn severity resulted in an increase in rilling; forested areas with high burn severity experienced gullying; and clearcuts and plantations with high burn severity experienced deep gullying, debris flows and small landslides. In contrast, for areas outside the fire perimeter with similar land base, storm damage was limited to stream crossings (Rust 2013 personal communication). Over a month after these precipitation events, water in Squaw Creek and Shasta Lake remained extremely turbid. See figure 3-4 above.

Burns that create very high soil surface temperatures − particularly when soil moisture content is low − result in an almost complete loss of soil microbial populations, woody debris and the protective duff and litter layer over mineral soil (Hungerford et al. 1991, Neary et al. 2005). Nutrients stored in the organic layer (such as potassium and nitrogen) can also be lost or reduced through volatilization and as fly ash (DeBano 1991, Amaranthus et al. 1989).

Fire-induced soil hydrophobicity is presumed to be an important factor of the observed post-fire increases in runoff and erosion from forested watersheds (Huffman et al. 2001). Though hydrophobicity is a naturally-occurring phenomenon that can be found on the mineral soil surface, it is greatly amplified by increased burn severity (Doerr et al. 2000, Huffman et al. 2001, Neary et al. 2005).

Soil hydrophobicity usually returns to pre-burn conditions in no more than six years (DeBano 1981). Dyrness (1976) and others have documented a much more rapid recovery of one to three years Huffman et al. 2001). The persistence of a hydrophobic layer will depend on the strength and extent of hydrophobic chemicals after burning and the many physical and biological factors that can aid in breakdown (DeBano 1981). This variability means that post-fire impacts on watershed conditions are difficult to predict and to quantify.

If hydrophobic soils result from a severe, high-temperature fire, moderate to high surface erosion could occur. The potential for mass failures would be low to moderate because of the overall land type characteristics within the project area; however, localized slope movement could occur, especially along roads on steeper mountain slopes.

Alternative 2 – Proposed Action (Revised)

Direct Effects

Watershed/Hydrology

The prescribed burn treatment would be primarily a mosaic of low-intensity fire and unburned ground. Small areas of moderate- and high-intensity fire could occur. Short-term increases in surface erosion would likely occur in some areas; however, the increase would not cause downstream impacts to beneficial uses. The greatest amount of sediment delivery would occur during the first year after treatment. Trends in sediment delivery over time would be toward background levels.

The low-intensity fire treatments would not affect overstory canopy cover in Riparian Reserves; therefore, changes in stream temperature are not anticipated. Project design features such as limiting how much of each sub-watershed can be burned in a given year (WILD-1c) and only allowing fire to back down into Riparian Reserves[43] would help to ensure that soil and water resources are adequately protected.

Geology

The direct effects of the prescribed burn would be predominantly low-severity fire, which would kill only small understory vegetation and leave most of the soil cover. Fire model runs estimate that none of the prescribed burn area would be at high or moderate intensity. However, design features to avoid burning or ensure low-intensity burns on active slides and slide prone areas (WATER-8) would be implemented and would minimize this occurrence. Several known caves exist within the project area, and the potential for others exists. The caves would be protected by project design features (WILD-3). No mechanized equipment or pile construction would be allowed on limestone outcrops (BOT-2, WILD-4).

Soil

Nitrogen is often the most limiting nutrient in forest ecosystems. Most nitrogen acquisition in forests comes from non-symbiotic fixation that depends on organic matter for energy (Harvey et al. 1989, in Brown 2003). Low-intensity fire can help release nitrogen from consumed organic matter and make it available to plants while maintaining enough on-site organic matter to protect soil productivity. The proposed fuel treatment is designed to meet forest soil ground cover requirements in treated areas (see Project Design Features above). The overall forest floor would be adequately maintained. Maintaining groundcover would prevent detrimental increases in surface erosion. Isolated pockets of soil may exist that do not currently meet forest groundcover requirements; these areas would be unlikely to burn under the prescription and should not be further impacted.

Hand pile burning would result in soil heating under the burned piles. The impacted areas would be minimal in extent and the effects would not be detrimental to soil properties on the greater landscape.

This alternative requires construction of new dozer fire line and minor maintenance (raking of litter) of existing dozer firelines (approximately 4.61 miles or 4 acres). These firelines have a

[43] Design feature RIPN-2 allows for fire to be ignited within Riparian Reserves under site specific conditions to achieve Aquatic Conservation Strategy objectives.

design width of eight feet, are primarily located on ridge tops, and are needed for implementation of the prescribed fire operations. Effects of these firelines would be scalping of topsoil, reduction of CWD, litter, and duff and increased compaction and erosion. These effects would be localized and site-specific to the firelines. On-site observations of existing firelines in the project area indicated little concern for any off-site impacts.

Indirect Effects

Watershed/Soils

Short-term increases in sedimentation and its associated turbidity and pH are possible after the initial post-implementation precipitation events produce runoff. Increases in turbidity and pH above background levels would be difficult to detect and would not be anticipated to impact downstream beneficial uses.

Geology

Because direct effects are anticipated to be predominantly low-severity burning of understory vegetation and forest floor litter, the proposed action is not expected to result in increased mass wasting or debris flow activity above existing levels. Exceptions would be small localized areas of higher-severity burn that would occur dispersed across some treatment areas. Project design features would be implemented to assure that unstable areas or caves would either be burned at low severity or remain unburned. Several known caves exist within the project area, and the potential for others exists. The caves would be protected by project design features.

Soil

Implementation of prescribed fire as proposed would not significantly disturb soil within the treated areas. Heat penetration into the soil surface during burning would be minimal. In general, pH, phosphorus (P) and exchangeable potassium (K), calcium (Ca), and magnesium (Mg) increase in the soil immediately after fire (Neary et al. 2005). In addition, some of the seedbed may be disturbed in isolated spots, which could display less vegetation growth over the short term. Erosion from the proposed activities would be minimal because the low-intensity burns would retain sufficient cover to protect the soil.

Most fires characteristic of prescribed fire are likely to enhance soil development and fertility over the long term by periodic release of nutrients (Harvey et al. 1989 in Brown 2003). Reducing the tons per acre of dead and live fuels in the treated areas would reduce the potential for severe fire behavior and the subsequent adverse effects to soils on National Forest within the project area.

The proposed action includes modification of the Forest Plan requirement for an average of 20 tons per acre of unburned dead/down material[44] for Management Prescription II (Limited Roaded Motorized) (Forest Plan, page 4-47) and 10 tons per acre for Management Prescription III (Roaded Recreation) to an average of 5 – 15 tons/acre for both management prescriptions. The proposed Forest Plan amendment would allow fuels reduction treatment of these areas. Dead and down material would be reduced; however, surface organic matter would be retained to protect soils. Conversely, if these areas are not treated, the risk to soil productivity would be

[44] Dead/down material includes fine organic matter and large woody material (often referred to as "coarse woody debris").

much greater from a high-severity wildfire. Modification of the dead/down requirement would, therefore, indirectly benefit soil productivity.

Alternative 3 – No Forest Plan Amendment

Direct Effects

Watershed/Soils

Direct effects would be slightly lower under this alternative than under Alternative 2 because fewer acres would be treated. As with Alternative 2, the prescribed burn would be primarily low-intensity fire with frequent unburned pockets. Small areas of moderate- and high-intensity fire would occur. Short-term increases in surface erosion would likely occur in some areas; however, the increase would not cause downstream impacts to beneficial resources. Trends in sediment delivery would be toward background levels. The low-intensity treatments would not affect canopy cover; therefore, changes in stream temperature are not anticipated.

Geology

This alternative would treat less area than Alternative 2. The direct effects of the prescribed burn would be predominantly low-severity fire, which would consume only small understory vegetation and leave the bulk of the soil cover. Mitigation measures to avoid or ensure low-intensity burns on active slides and slide prone areas are part of the project design criteria. Several known caves exist within the project area; and the potential for others exists. The caves would be protected by project design features.

Soil

Nitrogen is often the most limiting nutrient in forest ecosystems. Most nitrogen acquisition in forest systems comes from non-symbiotic fixation that depends on organic matter for energy (Harvey et al. 1989, in Brown 2003). Low-intensity fire can help release nitrogen from consumed organic matter and make available to plants while maintaining enough on site organic matter to protect soil productivity. The overall forest floor would be adequately maintained. The prescribed fuel treatment is designed to meet forest soil ground cover requirements in treated areas (see Project Design Features above). Maintaining groundcover would prevent detrimental increases in surface erosion. Isolated pockets of soil may exist that do not currently meet forest groundcover requirements. As with Alternative 2, these areas would be unlikely to burn under the prescription and should not be further impacted.

Hand pile burning would result in soil heating under the burned piles. The impacted areas would be minimal in extent and not be detrimental to soil properties on the greater landscape. Approximately 80 percent less area would be hand piled and burned in this alternative compared to Alternative 2.

Dozer line construction is not proposed under this alternative.

Indirect Effects

Watershed/Hydrology

As with Alternative 2, short-term increases in sedimentation and the associated turbidity and pH are possible after the initial post-implementation precipitation events produce runoff. Increases in turbidity and pH above background levels would be difficult to detect and would not be

anticipated to impact downstream beneficial uses. The potential for indirect effects under this alternative are slightly higher than under Alternative 2 because more acres would be treated.

As with soils and geology, indirect effects to watershed/hydrology of this alternative in untreated portions of the project area would be similar to Alternative 1 (no action).

Geology

The effects of this alternative would be very similar to those of Alternative 2 in the areas treated. Since direct effects are anticipated to be the result of predominantly low-severity fire, Alternative 3 is not expected to result in increased mass wasting beyond the existing condition. Potential for mass wasting events are comparable between the two action alternatives. Several known caves exist within the project area; and the potential for others exists. The caves would be protected by project design features.

As with soils, indirect effects to geology of this alternative in untreated portions of the project area would be similar to Alternative 1 (no action).

Soil

The prescribed fire would not significantly disturb soil within treated areas. Heat penetration into the soil surface during burning would be minimal. In general, pH, phosphorus (P), and exchangeable potassium (K), calcium (Ca), and magnesium (Mg) increase in the soil immediately after fire (Neary et al. 2005). In addition, some of the seedbed may be disturbed in isolated spots and display less vegetation growth over the short term. Erosion from this treatment would be minimal because these low-intensity burns would retain sufficient cover to protect the soil. Most fires characteristic of prescribed fire are likely to enhance soil development and fertility over the long term by periodic release of nutrients (Harvey et al. 1989 in Brown 2003). The proposed vegetation and fuel treatments would reduce the chance that a wildfire could have as severe an effect on the soils and surrounding private property in treated areas as it could in untreated areas because there would be a reduction in the tons per acre of dead and dying fuels on treated sites.

Indirect effects of this alternative in portions of the project area not treated would be similar to Alternative 1 (no action). The potential for future fire behavior to exceed most ground suppression capabilities in untreated areas under this alternative is high, with approximately 70 percent of the untreated landscape experiencing flame lengths greater than 8 feet. Mortality and canopy loss, as portrayed by crown fire potential, is expected to approach 70 percent as well. See the project Fire, Fuels and Vegetation Report for more detailed information.

Disturbance/Cumulative Watershed Effects

Drainages encompassing the project area have relatively low road/trail densities on National Forest lands (109 miles within project area approximately 30 percent are trails). Hiking and motorized trails cause localized impact to soil and water resources primarily at stream crossings. A review of existing stream crossings in the area found that there are approximately 340 stream crossings associated with the roads and trails in the project area and 28 percent of these crossings flow year round. These locations are points where streams are most susceptible to degradation. During large storm events these areas are highly susceptible to erosion transport, pipe plugging, loss of the crossings fill and at times stream diversion.

Impacts exist from historical mining activities. There are 73 historic mine sites (mostly extracting copper) located within the project area with a relatively high concentration of mine

sites along the lower portion of Squaw Creek. The mines along Horse and Town Creeks in this same general vicinity are contributing acid mine drainage and are considered impaired waters on the States 303d list (Environmental Protection Agency (EPA) 2001).

There are no grazing allotments within the project area and any impacts from grazing on National Forest lands are limited to those from wildlife. There are a couple of developed campgrounds Greens Creek and Chirpchatter within the project area. Impacts from hunting are limited in extent. Recreation, business and residential development exist within near proximity of the project area, and these activities depend on high quality waters.

Wildfire is also a source of disturbance. Although wildfire ignitions may occur from both lighting and human activity, wildfire is a natural process within the project area. Fire suppression has likely contributed to a potential for higher fire severity than in the last century. Current fuel conditions in the project area increase the risk of future intense fire behavior and adverse effects to resources. See the project Fire and Fuels Report for more detailed information.

Potential for high-intensity wildfire also increases the risk of landslides and debris flows, accelerated soil erosion (loss of soil productivity), and transport of increased sediment to surface waters. Increased sediment delivery has the potential to affect many beneficial uses, including recreation, domestic use and aquatic habitat. Accelerated sedimentation could also adversely affect cave resources because cave entrances are often situated along stream channels. Rapid in-filling of a cave can eliminate unique wildlife habitat that occurs there. As evident particularly in Upper Squaw Creek Sub-watershed, the recent Bagley Fire illustrates the effects of wildfires and past vegetation management on erosion processes (see figures 3-3 and 3-4 above).

A cumulative watershed effects analysis was conducted using the ERA model (see above). The existing condition was modeled for the year 2016 because the anticipated implementation of the project begins in 2015. The analysis assumes that no major disturbances would occur between the time of analysis and implementation of the project.

ERA Model

The ERA model tracks disturbances that affect watershed processes and serves as an indicator of watershed condition. The model compares the current and proposed level of disturbance within three watershed scales as additive ERA coefficients, with a theoretical maximum disturbance level or “threshold of concern” (TOC) for HUC5 watersheds developed by the Shasta-Trinity National Forest in the Forest Plan. These TOCs range from 12 percent to 18 percent and are based on watershed sensitivity. Watershed sensitivity is calculated based on the following: soil erodibility, slope, mass wasting potential and 25-year peak flow. A TOC of 14 percent (highly sensitive) was used for this analysis based on the above factors for the Pit Arm and Squaw Creek Watersheds, while a TOC of 16 percent was used for the McCloud Arm.

Past and present disturbances were summarized as recoverable or non-recoverable. Recoverable disturbances included in the analysis are Forest Service management projects and events such as thinning, prescribed burns, wildfire, and known activities on private lands such as those submitted in timber harvest plans. Non-recoverable disturbances include commercial and domestic developments, roads, railroads and trails.

Activities and wildfire data were compiled from the Forest Service corporate database (FACTS), the Shasta-Trinity National Forest GIS database and forest databases, the State of California ftp site for timber harvest plans, State census data for roads outside of Forest Boundaries, , and the

California Division of Mines and Geology. The data used for the CWE analysis was compiled by the Shasta-Trinity NF.

Cumulative Effects Common to Alternatives 2 and 3

The proposed treatments under either action alternative would not – and are not designed to – prevent wildfire from occurring within the project area in the next decade; however, the likelihood of smaller and/or lower-severity wildfires is greater than if the treatments were not implemented. The resulting cumulative watershed effects from future wildfires of lower severity would be less likely to impact downstream beneficial uses.

The ERAs resulting from the proposed action and Alternative 3 were determined in order to provide a relative comparison of planned ERA between action alternatives. Planned ERAs for each action alternative are shown in the project Soils Report. Post project that would result from implementation of project treatment activities range from a low of nearly 0 percent (about 1 acre) to a high of 5 percent in the HUC8 sub-drainages. The aggregated planned ERA for the 48 HUC8 sub-drainages is 2082 ERA for Alternative 2 and 663 for Alternative 3.

The ERA was calculated for the HUC5, HUC7, and HUC8 hydrologic units that include past, present and reasonably foreseeable disturbances. The ERA calculated from this data was compared to the TOC for each 5th field watershed. The ERA model represents a single point in time. This causes over prediction of potential impacts from both the proposed Green-Horse treatments and the I-5 Corridor activities because all of the treatments are calculated to take place at one time. The proposed treatments under both projects are scheduled for implementation over a period of seven to ten years. The adaptive management strategy that would be implemented under either action alternative would allow for scheduling of treatments to minimize cumulative impacts at the HUC7 and larger hydrologic units. For example, treatments may be spatially and/or temporally separated so that adjacent watersheds are not treated in consecutive years.

The 2012 Bagley fire occurred primarily in the in the headwaters of Squaw Creek HUC5 watershed as well as in HUC 5 Watersheds in the Upstream McCloud River and Pit River, but is outside of the Green-Horse project area.

ERA analyses for all three HUC5 watersheds, 14 HUC7 drainages, and 48 HUC8 sub-drainages within the project area were conducted for the No Action Alternative, which represents current and reasonably foreseeable conditions, Alternative 2 and Alternative 3. Reasonably foreseeable actions are also included in the Alternative 2 analysis. Proposed treatments under Alternatives 2 and 3 include prescribed fire, hand thinning and hand piling - although less acreage of these treatments in fewer watersheds is proposed in Alternative 3. Alternative 2 proposes approximately four miles of fireline construction/reconstruction, whereas Alternative 3 does not propose any dozer line construction/reconstruction. A separate analysis for Alternative 3 is not included in the report, because all proposed treatments in Alternative 3 are a subset of Alternative 2.

Table 3-25 below describes a matrix that models the magnitude, duration and extent of effects associated with disturbance levels.

Table 3-25. Characteristics of disturbance level ratings with regard to magnitude, geographic extent, duration and frequency

Disturbance Level Rating	Magnitude	Geographic Extent	Duration and Frequency
Low Risk ratio <0.4	Effect: Not measurable	Negligible Effects	Negligible Effects
Moderate Risk ratio <0.8	Effect: Potential for small sediment increase; no impact to fish or water quality	Impacts are minor locally and result in minimal offsite impacts	Short-term, one-time effect
High Risk ratio <1.0	Effect: Potential for moderate increase in sediment– minor stress on fish and minor increase in turbidity	Impacts are moderate immediately offsite but do not translate to watershed scale impacts	Moderate; intermittent effect
Very High Risk ratio >1.0	Effect: Potential for substantial increase in sediment; major stress on fish and large increase in turbidity and degraded water quality	Impacts are large immediately offsite and may translate to watershed scale impacts & degraded fisheries habitat	Long-term, potentially chronic effect

< = less than; > = greater than

Cumulative watershed effects modeling results for the HUC7 drainages, show an increase in percent ERA ranging from less than 1 percent to 3.5 percent based on the proposed treatments. Although the model presents a worst case scenario with all treatments occurring at the same time, none of the risk levels changes as a result of the proposed treatments. All modeled risk levels are low for the fourteen HUC7 drainages except for the Ski Island Pit-Island Pit Arm Shasta Lake which is moderate. The model predicts an increase of 1.4 percent ERA; however, three sub-drainages would be treated at different time intervals, and actual percent ERA increase would be lower. No adverse cumulative impacts to water quality are predicted to the HUC7 drainages as a consequence of the proposed treatments.

The most noticeable changes to the predicted risk ration are seen in individual HUC8 sub-drainages. Under Alternative 2, the worst case scenario, the CWE analysis predicts the risk level of five of the forty-eight sub-drainages proposed for treatment would change from low to moderate. The five sub-drainages are: 1802000311030301 (HUC7 Bully Hill-Squaw Creek Arm Shasta Lake), 1802000312020203 (HU7 Arbuckle Flat Pit Arm Shasta Lake), 1802000312020302 (HUC7 Reynolds Creek - Blue Canyon), 1802000312030202 (HUC7 Ski Island-Pit Arm Shasta Lake), and 1802000405020102 (HUC7 Campbell Creek-Dekkas Creek.

Figure 3-6 below illustrate CWE displayed in the above tables for Alternative 2.

Moderate disturbance levels predict short-term increases in sediment delivery with localized effects. Downstream impacts to beneficial uses are considered unlikely. The sediment delivery resulting from prescribed fire generally decreases by an order magnitude after the first year. Hydrologic recovery is expected within three years. The increase in sediment delivery from mass wasting as a result of the proposed treatments would be negligible.

Localized effects from increased sediment delivery are likely, primarily in 8th field (HUC8) sub-drainages. This model assumes that all treatments would occur within one year, when treatments would actually occur over a period of up to ten years. Consequently, treatments in any HUC7

and HUC5 watersheds would be staggered, thus reducing the potential for offsite cumulative effects.

Implementation of prescribed fire treatments prior to wildfire is likely to reduce future wildfire burn severity. This reduction in burn severity would, in turn, reduce wildfire effects on stream and riparian ecosystems (Pilliod et al. 2008). Therefore, no adverse cumulative effects from implementation of either action alternative, when combined with the effects of future wildfires, would be expected to occur.

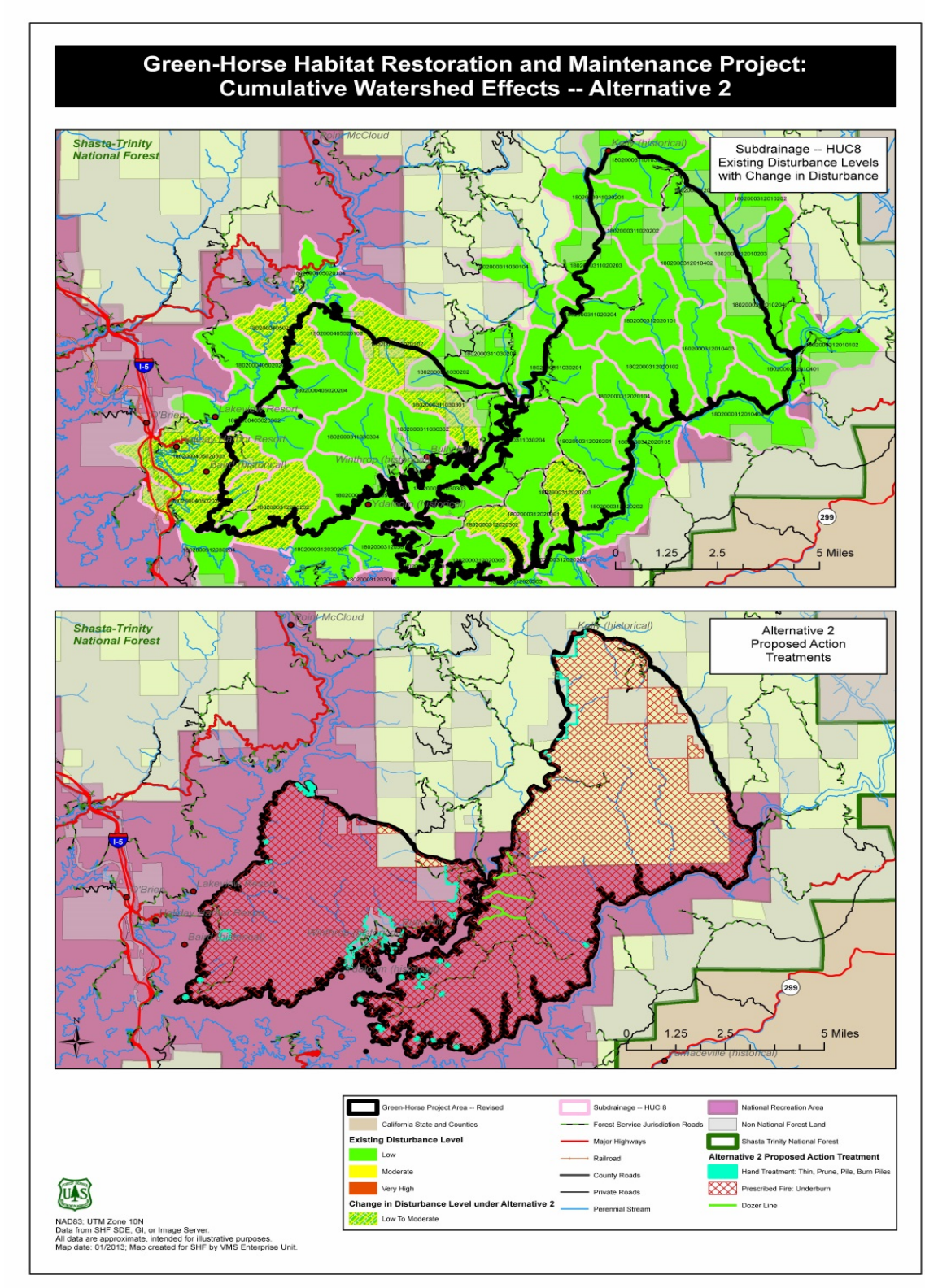

Figure 3-6. Cumulative Watershed Effects predicted for Alternative 2

Aquatic Wildlife Species[45]

The aquatic wildlife species analysis addresses effects to special status species (in compliance with the Endangered Species Act and Forest Service Manual [FSM] 2670 direction) and management indicator assemblages (in compliance with the Forest Plan and NFMA).

The cumulative effects analysis area for the aquatic species analysis includes 51 8th-field drainages (HUC 8) contained within portions of three 5th-field watersheds (HUC 5) in the project area. Campbell Creek, Potem Creek, Squaw Creek and West Fork Didallas Creek serve as analysis area boundaries. Squaw Creek is the only fish-bearing stream with its headwaters upstream from and outside of the analysis area. The HUC 8 and HUC 5 watersheds are described in the Hydrology, Geology and Soils section above.

The time period for measurement of cumulative effects is 20 years after the completion of project activities or, in the event the no action alternative is selected, 20 years from the date of the decision.

Affected Environment

Special Status Aquatic Species

Federally Listed Threatened and Endangered Species and Essential Fish Habitat[46]

Fish species that are federally listed as threatened or endangered on the Shasta Trinity National Forest for the Sacramento River system include Central Valley spring run Chinook salmon and winter run Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley steelhead (*Oncorhynchus mykiss*), and North American green sturgeon (*Acipenser medirostris*), all of which are blocked from accessing their historic range by Shasta Dam. As a result of this barrier, no federally listed fish species occur within the analysis area. Additionally, Conservancy fairy shrimp (*Branchinecta conservation*), vernal pool tadpole shrimp (*Lepidurus packardi*) and Shasta crayfish (*Pacifastacus fortis*) are federally listed as endangered; vernal pool fairy shrimp (*Branchinecta lynchi*) and delta smelt (*Hypomesus transpacificus*) are federally listed as threatened. None of these species occur within the analysis area.

A no effect Biological Assessment was prepared to document that the analysis area lies outside of the range of federally listed Threatened, Endangered or Proposed aquatic species and their habitats. None of the alternatives, therefore, would affect Central Valley spring run Chinook salmon, winter run Chinook salmon, Central Valley steelhead, North American green sturgeon, delta smelt or Shasta crayfish and their habitats. Because anadromous fish species do not occur within the analysis area, none of the alternatives would affect Essential Fish Habitat. Accordingly, these species and habitats will not be discussed further.

[45] The Aquatic Wildlife Species section of this DEIS summarizes information contained in the Green-Horse Fisheries Report. The report is incorporated by reference and is part of the project planning record located at the Shasta Lake Ranger Station.
[46] See USDI Fish and Wildlife Service 2012

Forest Service Sensitive Aquatic Species[47]

Sensitive species for the Forest are listed on the Region 5 Regional Forester Sensitive Species List (last updated in 2013). Sensitive Species that may occur in the analysis area include the following:

Hardhead minnow	*(Mylopharodon conocephalus)*
Black juga	*(Juga Nigrina)*
California floater	*(Anodonta californiensis)*
Nugget pebblesnail	*(Fluminicola seminalis)*
Scalloped juga	*(Juga [Calibasis] occata)*

Forest Service Sensitive Species that do not occur within the analysis area include Klamath Mountains province steelhead, kneecap lanx, McCloud River redband trout, montane peaclam, Pacific lamprey, upper Klamath/Trinity Chinook salmon spring run and upper Trinity River Chinook salmon fall run. None of the alternatives, therefore, would affect these seven species. Accordingly, these species will not be discussed further.

Hardhead minnow (Mylopharodon conocephalus)

Hardhead minnows are typically found in relatively undisturbed low-elevation streams. They are omnivores that forage on drifting invertebrates and aquatic plant material, and on zooplankton in reservoirs. This species prefers moderate velocity water and are mostly observed in runs or pools in stream systems or associated with surface waters in reservoirs. Hardhead migrate to tributaries in April and May and spawn by broadcasting eggs over gravel riffles or runs. One of the biggest threats to hardhead is predation by non-native bass species. Hardhead usually occur with Sacramento pike minnow and Sacramento sucker. They are documented as present in Shasta Lake in small numbers (Moyle 2002).

Surveys for hardhead were completed in the lower McCloud River and the Pit 7 afterbay in 2007 and updated in 2009 for the McCloud-Pit Project FERC relicensing. Both snorkeling and electrofishing methods were used at locations upstream of Shasta Lake and outside of the analysis area. Hardhead were found in the Pit 7 afterbay during these surveys and although not found in the McCloud River, suitable habitat was identified (PG&E 2007). California Department of Fish and Wildlife conducted boat electrofishing surveys in the Pit Arm of Shasta Lake in 2000 and 2001 and hardhead were not found. Although hardhead minnows have not been recently documented in the analysis area, because they have been identified just upstream of the project for this analysis they are presumed to be present.

Black juga (*Juga nigrina*)

Black juga is a freshwater snail found in spring pool and stream habitats. This species and other members of this genus are thought to live about 5 to 7 years and reach maturity in about 3 years. They prefer cool water temperatures below 18^{o} C and saturated dissolved oxygen levels. Black juga are not known to disperse far, typically a few meters in the summer months in stream habitats (Furnish 2014).

[47] See USDA Forest Service 2013

This species has been historically described as commonly occurring in tributaries of the Sacramento River and interior drainages of northeastern California, locally in the upper Klamath River, the uppermost Eel River drainage, the Napa River and coastal streams of Mendocino County (Big and Noyo rivers) and south into the Russian River drainage of Sonoma County (Taylor 1981 in Furnish 2014). More recent documentation describes black juga, as presently understood taxonomically, restricted to the upper Sacramento system in California with populations in Clear Creek, Shasta County, upstream of Whiskeytown Lake and in tributaries upstream of Shasta Lake. Within the action area these include Potem Creek and an unnamed tributary to the Pit River arm of Shasta Lake within the eastern-most portion of the Action Area (Frest and Johannes 1995 in Furnish 2014).

California floater (Anodonta californiensis)

The California floater is a mussel that lives in shallow areas of clean, clear lakes, ponds and large rivers. They prefer lower elevations and soft, silty substrates of mud and sand. Most of these clams are found in slow water pool habitats; sometimes they occur in run habitats but are rarely if ever are found in riffle habitats. Their life cycle includes a parasitic larval stage, which is dependent on host fish for food and dispersal. Host fishes have not been completely verified but may include speckled dace (*Rhinicthys osculus*).

The declines of native host fish species, as well as other factors, have been identified as likely causes of the decline of California floaters (Furnish 2007). It is believed that they have been eradicated from much of their former range in Shasta County – including the upper Sacramento River –but that they occur in both the Fall and Pit River systems (Frest and Johannes 1995 in Furnish 2007). They are sensitive to changes in water quality, particularly high nutrient levels and excessive sedimentation. Mollusk surveys completed for the McCloud-Pit Project report findings of California floater in the Pit 7 Reservoir, upstream from Shasta Lake (PG&E 2008). Recent mussel survey results are not available for much of the waters in the analysis area to definitively determine the presence or absence of this species. For purposes of this analysis they are assumed to be present.

Nugget pebblesnail (*Fluminicola seminalis*)

The nugget pebblesnail is a rare snail that prefers cool, clear, flowing water and gravel-cobble substrates. It is typically found in larger creeks and rivers, but is also occurs on soft, mud substrates in large springs. This species has been documented in the McCloud River basin (Furnish and Monthey 1998), the Pit River basin including large, spring-fed tributaries (Hershler and Frest 1996), and – according to Shasta-Trinity National Forest GIS data – is known from three sites on the Forest in the lower reaches of the McCloud River upstream of the project area. Nugget pebblesnails are currently considered moderately common in the Pit and McCloud Rivers and their tributaries (Furnish 2007).

Scalloped juga (*Juga* (*Calibasis*) *occata*)

The scalloped juga is a Sacramento River native species that was once widespread in the lower Sacramento River, but is now believed to be extirpated there (Frest and Johannes 1993 in Furnish 2007). It prefers large river habitats and is found generally at low elevations in cold swift water under loose but stable boulders and cobbles. Mining, degraded water quality and dams are this species largest historical and present day threats (Furnish 2007). The species has been found at a few widely separated sites in the lower Pit River system but has not been recorded as occurring in the analysis area (Furnish 2007). For purposes of this analysis they will

be assumed to be present since recent extensive surveys within the analysis area have not been completed for this species.

Survey and Manage Species

Several survey and manage aquatic mollusk species potentially occur within the analysis area. These include: the Potem pebblesnail (*Fluminicola* n. sp. 14), flat-top pebblesnail (*Fluminicola* n. sp. 15), Shasta Springs pebblesnail (*Fluminicola* n. sp. 16), disjunct pebblesnail (*Fluminicola* n. sp. 17), globular pebblesnail (Fluminicola n. sp.18), cinnamon juga (*Juga (oreobasis*) n. sp 3) and canary duskysnail (*Lyogyrus* n. sp 3).

Pebblesnail species are associated with small, perennial cold water spring habitats with a variety of substrate sizes. They are considered rare because they occur at a few highly localized sites with restricted habitats. Pebblesnails are highly sensitive to water pollution, oxygen deficits, elevated water temperatures, and excessive sedimentation. The cinnamon juga is known as a river snail but has mostly been found in large spring complexes with fewer records in river habitats (Furnish and Monthey 1998). This species is sensitive to oxygen deficits, elevated water temperatures and sedimentation (Frest and Johannes 1995 in Furnish and Monthey 1998). Canary duskysnails are found in both cold spring complexes and spring-fed portions of river habitats. They prefer shady areas and occur under loose cobbles and boulders. Like other aquatic snails, they are sensitive to oxygen deficits, elevated water temperatures and excessive sedimentation (Furnish and Monthey 1998).

Research on pebblesnail species is ongoing. In a paper by Hershler and others (2007), the DNA of several *Fluminicola* species occurring in the upper Sacramento River basin (Sacramento River headwaters and the McCloud and Pit Rivers) was examined to further describe species separations and their physical ranges. Most species occurring in known locations in waters upstream from Lake Shasta occupy very specific geographic locations. While known large spring complexes in the upper Sacramento basin (including the McCloud and Pit River drainages) have been surveyed and some monitored over several years, smaller springs in the analysis area – both mapped and un-mapped – have not been surveyed. Perennial springs located within the analysis area may support described and potentially undescribed species of aquatic mollusks.

Potem pebblesnails have been found in the upper Sacramento River (Furnish and Monthey 1998) but are mostly restricted to the lower Pit River (Hershler et al.2007) and, according to Shasta-Trinity National Forest GIS files, have been found along Potem Creek within the analysis area.

Recently, four groups of snails considered to be separate species, but not all formally described, were grouped under one species. The Shasta pebblesnail, formally named and described in 2007 by Hershler and others (2007), may now include the Sacramento pebblesnail (*Fluminicola* n. sp. 1) (Frest and Johannes 1995), the flat top pebblesnail (*Fluminicola* n. sp. 15), the Shasta Springs pebblesnail (Fluminicola n. sp. 16) and the disjunct pebblesnail (*Fluminicola* n. sp. 17). *Fluminicola* n. species 15, 16 and 17 were previously identified as Survey and Manage species (76 FR 61826). These three species are known to occur specifically in the Sacramento River headwaters in the Shasta Springs area. They are unlikely to occur within the Green-Horse analysis area.

Cinnamon juga is a rare species endemic to the upper Sacramento River and is unlikely to occur in the analysis area. The canary duskysnail is known from two sites in Shasta County; the first area is a very large cold spring and spring-influenced area of the Pit River upstream from the

project area, the other site is on the boundary of the Shasta National Forest outside of the analysis area (Furnish and Monthey 1998).

Because of the specialized habitat requirements and very specific locations of most of the described Survey and Manage aquatic mollusk species, it is unlikely that any except the Potem pebblesnail occur within analysis area drainages. However, extensive surveys have not been done in spring and seep habitats in the analysis area.

On February 18, 2014, the District Court for the Western District of Washington issued a Court order allowing the Forest Service to continue developing and implementing projects that met the 2011survey and manage Settlement Agreement exemptions or species list, for three categories of projects. The Green-Horse Habitat Restoration and Maintenance Project is consistent with Category 3: projects, at any stage of project planning, that the Agencies designed to be consistent with one or more of the new exemptions contained in the 2011 Settlement Agreement on or before April 25, 2013.

The Green-Horse Habitat Restoration and Maintenance Project is in compliance with and relies on the Survey & Manage Settlement Agreement and court order signed July 5, 2011: *Conservation Northwest v. Sherman*, Case No. 08-1967-JCC (W.D. Wash).[48] Thus, surveys were not performed for this project because non-commercial hazardous fuels treatment such as prescribed burning was indicated as exempt from required survey under the 2011 Survey and Manage Settlement Agreement (Pechman exemption[49] for hazardous fuels treatments where prescribed fire is applied).

Aquatic Management Indicator Assemblages

The Forest selected management indicators to ensure that viable populations of wild native fish are maintained or to enhance populations of desirable introduced fish species. Fisheries assemblages and species for the Shasta-Trinity National Forest are identified in the Forest Plan (Forest Plan, page 3-11). The management indicator assemblages for the Project were selected from this list, as shown in Table 3-27 below, which identifies assemblages, categorizes them relative to effects of the project, and lists the representative species.

Management indicator species whose habitat could be either directly or indirectly affected by project activities (identified as Category 3 in Table 3-26) are carried forward in this analysis. They include the following:

- Inland Coldwater Fish Assemblage: Resident Rainbow Trout
- Inland Warmwater Fish Assemblage: Largemouth Bass

[48] Settlement Agreement; Conservation Northwest v. Sherman, Case No. 08-1967-JCC (W.D. Wash.) signed July 5, 2011.
[49] October 11, 2006 modified injunction order in Northwest Ecosystem Alliance v. Rey (Case 2:04-cv-00844-MJP, Doc. No. 109)

Table 3-26. Management Indicator Assemblages and selection of representative species for project-level analysis

Management Indicator Assemblages	Selected Assemblage Representative	Category for Project Analysis
Anadromous Fish Assemblage	Steelhead: winter and summer-run	1
Anadromous Fish Assemblage	Spring-run Chinook Salmon	1
Inland coldwater fish assemblage	Rainbow Trout	3
Inland warmwater fish assemblage	Largemouth Bass	3

Category 1: Management indicator assemblage whose habitat is not in or adjacent to the project area and would not be affected by the project.

Category 2: Management indicator assemblage whose habitat is in or adjacent to project area, but would not be either directly or indirectly affected by the project.

Category 3: Management indicator assemblage whose habitat would be either directly or indirectly affected by the project.

Winter and summer-run steelhead and spring-run Chinook salmon, identified as Category 1, will not be further discussed because habitat for the anadromous fish assemblage would not be directly or indirectly affected by either action alternative. No species were identified as Category 2.

Inland Warm Water Assemblage

Largemouth bass (*Micropterus salmoides*) prefer warm, shallow waters with moderate clarity and heavy growth of aquatic plants for hiding cover. They can occupy stream habitats during low flows but are easily flushed out of streams with higher flows. Largemouth bass can withstand adverse water conditions with high temperatures and low dissolved oxygen levels. In large lakes individuals stay fairly close to shorelines in water depths of one to three meters. Fry feed mainly on small crustaceans, while juvenile and adult bass feed on aquatic insects and other fish, including their own species and occasionally on crayfish and frogs. Spawning is in spring in shallow depressions created in sand, gravel or debris-littered lake bottoms from 0.5 to 2 meters in depth (Moyle 2002). Largemouth bass occur in small numbers throughout Shasta Lake waters and could potentially utilize the lower reaches of slower velocity perennial streams within the analysis area.

Inland Cold Water Assemblage

Rainbow trout are found in clear, cool perennial waters. Other habitat requirements include clean gravels for spawning, cobble and boulder substrate for velocity refuge and cover, large woody debris for cover and habitat complexity, and other diverse habitat elements including deep pools, riffles, cascades and side channel habitat. Different size and age classes of rainbow trout utilize varying depth, velocity and cover microhabitats. Fry utilize shallow waters along stream edges with low water velocities, juveniles utilize deeper, faster water with cover components, and adults often utilize pool habitat close to swift headwaters to maximize foraging opportunities on drifting invertebrates. Rainbow trout can be aggressive and territorial but interact successfully with other non-salmonid species such as Sacramento suckers (Moyle 2002).

Approximately 27.5 miles of rainbow trout habitat occurs in several perennial streams in the analysis area, namely Squaw Creek, Potem Creek and Ripgut Creek, approximately 19.5 of these

miles are on NFS lands. Table 3-28 below under the Aquatic Habitat section displays the names and miles of fish-bearing perennial streams associated with the project.

Population Estimates of Management Indicator Assemblages

Population estimates for both resident rainbow trout and largemouth bass in analysis area waters are lacking. The Forest Service does not routinely conduct population estimates or manage fish populations per se, but rather manages habitat on NFS lands for these species. Relevant recent population surveys from the California Department of Fish and Wildlife are not available. Based on field observations and limited survey data, the limiting factors for trout in the project area appear to be low summer base flows and steep gradients. Limiting factors for largemouth bass appear to be steep-sided lake banks, lack of cover in lake waters, reservoir water level fluctuations and competition from other introduced game fish species (USDI Bureau of Reclamation 2003).

Aquatic Habitat

Shasta Lake provides fish habitat for a variety of both warm water and cold water fisheries and other aquatic species. Warm water species are mostly introduced and include bluegill (*Lepomis macrochirus*), brown bullhead, (*Ameiurus nebulosus)*, channel catfish (*Ictalurus punctatus*), black crappie (*Pomoxis nigromaculatus*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), spotted bass (*Micropterus punctulatus*), threadfin shad (*Dorosoma petenense*), and others. Cold water species include but are not limited to rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutto*), and landlocked Chinook salmon (*Oncorhynchus tshawytscha*). Habitat for warm water lake fishes is limited by steep-sided lake banks, water level fluctuations, and a lack of shoreline and shallow water cover for juvenile fish (USDI Bureau of Reclamation 2003).

Tributary streams to Shasta Lake within the analysis area provide approximately 27.5 miles of perennial fish habitat above the lake full-pool level. These streams predominantly provide habitat for rainbow trout and may also provide habitat in their lower reaches for other native species such as Hardhead minnow, Sacramento sucker (*Catostomus occidentalis*), Sacramento pike minnow (*Ptychocheilus grandis*), native mollusks, and introduced lake species such as largemouth and smallmouth bass.

Table 3-27 below displays the miles of perennial fish-bearing habitat by stream within the analysis area (these miles include non-NFS lands). Stream fish habitat within smaller channels is generally limited by low water flows, steep gradients, and fish passage barriers caused by reservoir fluctuations and excessive shoreline erosion or deposition. Most streams in the analysis area are either intermittent or ephemeral and do not provide year-round habitat for fish or other aquatic species but may provide spawning habitat during winter and spring flows.

Table 3-27. Miles of fish-bearing stream habitat

Stream Name	Miles of Fish-Bearing Stream Habitat
Brock Creek	0.4
Campbell Creek	2.3
Flat Creek	3.1
No Name	1.6
Potem Creek	6.2

Stream Name	Miles of Fish-Bearing Stream Habitat
Ripgut Creek	4.4
Squaw Creek	8.2
West Fork Didallas Creek	1.3
Total	**27.5**

Stream miles shown are calculated from the full-pool level of Lake Shasta. Streams with less than 0.05 miles were not considered. The range of resident rainbow trout in the Shasta-Trinity National Forest GIS library was used to calculate the miles of perennial fish-bearing stream

Two seeps or springs have also been identified in the analysis area. These may provide habitat for native freshwater mollusk species.

Eighteen of the 51 HUC-8 drainages identified as the analysis area contain fish-bearing stream habitats. In one drainage the entire fish-bearing stream reach within the HUC 8 boundary is on non-federal lands. Table 3-28 below displays the treatment acres by alternative in HUC 8 drainages with perennial fish-bearing stream habitat on National Forest System lands.

Table 3-28. HUC 8 drainages with fish-bearing stream habitat on NFS lands

HUC 8 Designation	Alternative 2 Treatment Area (acres)	Alternative 3 Treatment Area (acres)	Percent of Drainage within Alt. 2 Treatment Area	Percent of Drainage within Alt. 3 Treatment Area	Percent of Non-National Forest Area within Drainage	Miles of Perennial Fish-Bearing Stream Habitat on National Forest System lands
1802000311010305	1106.2	1106.2	41	41	18	0
1802000311020201	467.2	467.2	31	31	24	0.6
1802000311020203	863.1	856.1	46	46	24	1.8
1802000311020204	1242.3	793.6	88	56	0	1.3
1802000311030201	1467.6	557.9	72	27	0	0.5
1802000311030202	206.4	0	16	0	10	1.3
1802000312010201	604.2	604.2	28	28	47	0.3
1802000312010202	35.7	35.7	2	2	48	0.3
1802000312010203	118.6	118.6	8	8	44	0.3
1802000312010204	639.4	518.2	27	22	41	1.6
1802000312010401	777.4	444.5	59	34	19	1.7
1802000312010402	906.2	906.2	58	58	42	1.0
1802000312010403	1770.2	1654.0	100	93	0	3.4
1802000312020101	1537.9	1537.9	100	100	0	1.6
1802000312020102	1912.1	1523.7	100	80	0	1.5
1802000312020104	1046.4	770.6	100	74	0	0.4
1802000405020102	777.6	0	36	0	16	1.6

HUC 8 Designation	Alternative 2 Treatment Area (acres)	Alternative 3 Treatment Area (acres)	Percent of Drainage within Alt. 2 Treatment Area	Percent of Drainage within Alt. 3 Treatment Area	Percent of Non-National Forest Area within Drainage	Miles of Perennial Fish-Bearing Stream Habitat on National Forest System lands
1802000405020103	1023.0	0	84	0	2	0.3
Total						**19.5**

Environmental Consequences

The analysis of environmental effects to aquatic habitats considers those factors that have the greatest potential to impact water quality and quantity. Factors considered in this analysis include proximity of the proposed activities to habitat, the extent of the geographic area where disturbance may occur, the nature of the effect on habitat, the duration of effect, disturbance intensity and severity, and consistency with Aquatic Conservation Strategy (ACS) Objectives.

Alternative 1, No Action

Direct, Indirect and Cumulative Effects

With no prescribed burning activities, hand thinning, brush cutting, pruning, and pile and burning, there would be no direct effects to Sensitive aquatic species, aquatic Survey and Manage species, aquatic Management Indicator Species or their habitats. However, there is potential for indirect effects associated with future wildfire behavior.

Because no treatment would occur in Riparian Reserves, existing dense vegetation conditions would persist and would be expected to become denser, which would leave these areas susceptible to the effects of a future high-severity wildfire. Widespread removal of riparian vegetation from a high-severity fire would increase sediment delivery to aquatic habitats and negatively affect aquatic species by increasing water temperatures, reducing pool quality, and disrupting channel maintenance processes for several years following the fire. High-severity wildfire would also likely result in increased mortality of riparian vegetation, reducing stream shade and increasing stream water temperatures until riparian vegetation was re-established.

The Wildfire and Fuels section above identifies a high potential for fire behavior to exceed most ground suppression capabilities under the no action alternative. The severity and size of future wildfires would determine the cumulative watershed effects of the no action alternative. If widespread, high-severity fire were to occur as predicted, vegetation mortality and canopy loss modeled by crown fire potential would be extremely high and include consumption of riparian reserve vegetation.

Widespread high-severity fire in Riparian Reserves would result in changed aquatic habitat conditions including increased sediment deliver to stream channels from surface erosion and mass wasting, increased stream temperatures from loss of riparian shade and a decrease in the quality of instream habitat features such as pools, spawning gravels and channel maintenance processes. See figure 3-4 above for an illustration of sediment delivery that was observed in Squaw Creek as a result of erosion from the Bagley Complex of fires in 2012.

Effects Common to Alternatives 2 and 3

Direct and Indirect Effects

Effects to Aquatic Species Habitat

Sediment and Substrate

Activities that remove high amounts of soil cover or cause large areas of compacted soil have the greatest potential for accelerated erosion and aquatic habitat impacts. As described in the Hydrology, Geology and Soil section above, the proposed fuel treatments are designed to meet forest soil ground cover requirements, which prevent detrimental increases in surface erosion.

Prescribed fire treatments applied over a period of 7 to 10 years (with 10-14 percent of total treatment acres accomplished each year) would result in a mosaic of predominantly low fire severities or unburned vegetation, with very small and limited areas expected to burn at moderate or high severity. Soil cover retention standards in design features (WATER-2 and WATER-3) and implementation of BMPs would minimize accelerated erosion. Burn prescriptions call for retention of adequate ground cover to meet soil quality standards. Residual post-fire soil cover in low to moderate fire severity areas and needle and leaf cast from overstory vegetation would provide adequate groundcover to limit both surface erosion and potential sediment transport to aquatic habitats following prescribed burning activities.

Although design features and BMPs will minimize erosion, minor amounts of fine sediment exposed by prescribed fire is expected to be washed downslope during the first few post-burn precipitation events large enough to cause runoff from hillslopes. Most fines would settle out in vegetation and duff but some may be delivered to stream channels during storm events. The amount of turbidity added to streams from these fines is expected to be small in magnitude, very localized and of short duration. It is not expected to be measureable from background increases in storm runoff turbidity. Where aquatic species are found, effects are expected to be negligible and would have a discountable probability of impacting aquatic species. Growth of herbaceous vegetation during the first growing season after prescribed fire treatments would also further reduce the risk of sediment delivery to stream channels.

Hand thin/prune/pile/pile burn treatments would have low potential to remove ground cover to the extent where the erosion hazard would be increased. Work would be done by hand so compaction and disturbance are minimal. Duff and litter on the ground surface would remain relatively undisturbed and would provide adequate cover to minimize erosion. Surface-derived sediment from these activities is considered short-term in duration (one rainy season following activities), and is expected to be minor and dispersed and undetectable from background levels. Burn piles may leave relatively bare areas, but piles would be localized, distributed so they are isolated from one another and scattered to reduce impacts.

Although hand thin/prune/pile/pile burn treatments are proposed within Riparian Reserves, site-specific prescriptions and project design features (WATER and RIPN) would minimize the sediment delivery potential resulting from these activities. Riparian Reserves would effectively buffer potential sediment delivery to aquatic habitats. The generally low intensity of project activities would minimize the disturbance or consumption of the fine organic component, would maintain adequate soil cover, and would maintain soil porosity levels.

Hand thin/prune/pile/pile burn treatments would not generate accelerated erosion rates and would have no sediment-related effects to aquatic species or their habitats. There would be

short-term increases (one to three years post treatment) in sediment production and slightly negative effects to sediment and substrate aquatic habitat indicators due to prescribed burning. These effects are expected to be small in magnitude, very localized and only at the site scale.

Shade/Water Temperature

Stream temperatures are not expected to increase as a result of proposed activities under either action alternative. Hand treatments would remove up to 8 inch dbh conifers and up to 4 inch dbh hardwood species. Both types of treatments would retain all larger sized overstory vegetation providing shade to perennial waters; in addition, effective shade over water in Riparian Reserves would not be reduced below 80 percent where it exists (RIPN-9). The proposed activities would not measurably reduce stream shade; therefore, water temperature is not expected to increase. For all treatments in Riparian Reserves the long-term effect on riparian canopy shade is expected to be positive. Reducing understory canopy would, in the long term, allow increased growth in remaining larger vegetation and potentially increased shade.

Prescribed burning within Riparian Reserves may result in slight, short-term and localized increases in water yield due to decreased evapo-transpiration. Increased soil moisture from treatments would be captured by the residual vegetation (resulting in increased growth) with no measurable increases to stream flow or stream temperature.

Water Quality

The most likely change in water quality would be an increase in nutrient levels (especially phosphate) as a result of increased sediment production. As discussed in the Sediment and Substrate section above, the probability of sediment increases from project activities is low with no measureable change to aquatic habitats; therefore, effects from increased nutrient levels would also be very low. As disclosed in the Hydrology, Geology and Soils section above, short-term increases in surface erosion would not cause downstream impacts to beneficial uses; the greatest amount of sediment delivery would occur during the first year after treatment, with trends over time toward background levels.

Riparian Reserves

Prescribed burning in Riparian Reserves would reduce background existing dead fuels and kill low growing vegetation and small trees to reduce ladder fuels and reduce the threat of a crown fire within treated Riparian Reserves. Hand treatments would effectively reduce ground and ladder fuels with no change in overstory canopy vegetation. In the long term, shade would be retained and potentially improved in Riparian Reserves that are treated and adjacent to areas where treatments occur.

Treatments in the Riparian Reserves of seasonally flowing streams may also contribute to reduced fire severity at the watershed scale. Taylor and Skinner (1998) studied fire history in the Klamath Mountains and found that fires were frequent in the steep upper reaches of intermittent streams. They concluded that it is likely that the intermittent channels in these upper reaches acted as chutes in which fires spread easily and possibly burned with more intensity compared to the landscape overall. Therefore, strategic treatment in some Riparian Reserves in addition to the upland areas can contribute to the overall protection of the watersheds in the project area.

Activities proposed under either action alternative would have an overall neutral effect on aquatic habitat indicators. These actions are not expected to introduce measurable instream fine sediment into perennial streams or perennial springs and seeps. Baseline conditions for all

instream habitat elements would be maintained including substrate character, embeddedness, pool frequency, pool quality, width to depth ratio, and streambank condition.

There are no expected measurable changes to physical channel or habitat conditions from the activities proposed in either of the action alternatives. The long-term trend would be a slight improvement in overall riparian and aquatic conditions in the analysis area because of the reduced threat of high severity wildfire in the analysis area watersheds.

Sensitive Aquatic Species

There would be no direct effects to sensitive aquatic species under either action alternative, because the proposed activities would not occur within aquatic habitats including streams, springs, seeps or lakes and are limited within Riparian Reserves (design features RIPN-1 through RIPN-10). Neither action alternative would alter habitat access for sensitive aquatic species.

Sensitive aquatic species may be exposed to slight increases in turbidity and fine sediment during storms that occur following implementation of project activities in any given year. Project design features and BMPs would minimize the amount of sediment generated by project activities. Functioning Riparian Reserves would provide filtering for most off-site potential sediment movement, and soil cover standards would provide protection from surface erosion.

Because fire is a natural watershed disturbance in this area, native species are adapted to persist under the natural fire regimes and associated watershed conditions. Although sensitive aquatic species may be exposed to slight increases in turbidity and fine sediment during storms post-treatment, there is low probability that the amount generated from project activities would adversely affect patterns of migration, reproduction, or rearing.

Management Indicator Assemblages

Although project implementation under either action alternative would result in slight changes to components of assemblage habitats such as substrate and turbidity, streams, springs and seeps would continue to provide the same quantity and distribution of fisheries indicator assemblage habitats following project implementation. Therefore, neither action alternative is likely to result in any meaningful change to population trends and habitat availability for largemouth bass or rainbow trout.

Cumulative Effects

Ongoing and reasonably foreseeable federal actions considered for the cumulative effects analysis for the project include the following: recent and on-going vegetation treatment activities including thinning, prescribed burning, and other fuels reduction activities on NFS lands. There is also extensive recreation use within the analysis area including commercial marina facilities, hiking, boating, fishing, OHV use, camping, and hunting. Non-recreation uses include private property inholdings, private development, transmission lines and communication sites.

Infrastructure projects conducted by the Bureau of Reclamation (BOR) are also included. The Bureau of Reclamation is considering raising the top elevation of Shasta Dam to increase water storage capacity. Initial evaluations have been conducted and an Environmental Impact Statement (EIS) has been released. The preferred alternative would raise the dam elevation by eighteen feet. The time of installation, if the dam raise is approved, is unknown but could occur during the Green-Horse project implementation or recovery period.

As shown in the CWE analysis summary, impacts of the action alternatives on watershed conditions would be minor. Both action alternatives would slightly increase cumulative watershed risk relative to existing conditions, mostly due to prescribed fire activities. However, post-project cumulative watershed risk in perennial, fish-bearing drainages remains low, well below the threshold of concern (TOC) value of 1.0. Local impacts would be minor and would result in minimal offsite impacts. Design features and BMPs that reduce potential disturbance and risk would be used during project implementation.

Alternative 2 – Proposed Action (Revised)

The 4.61 miles (4 acres) of dozer fireline construction or reconstruction proposed under this alternative would occur on ridgetops in the project area. Dozer lines would be primarily on ridge tops, are not located in HUC 8 drainages that support fish bearing streams and are not located near perennial water sources. Effects of the proposed dozer lines would be localized, site-specific increases in soil compaction and surface erosion that are not expected increase sediment delivery to stream channels.

Project design features (WATER-1, RIPN-3 and RIPN-8) restrict the operation of heavy equipment (i.e. dozers) in Riparian Reserves and dry intermittent and ephemeral channels. No effects to aquatic species habitat from dozer line construction would be expected to occur. BMP 2.12 would guide all fueling and lubricating actions; therefore, this activity would not cause chemical contamination of aquatic habitat.

All other effects of Alternative 2 are discussed above under Effects Common to Alternatives 2 and 3.

Alternative 3 – No Forest Plan Amendment

Because Alternative 3 would treat only about one-third of the project area, fuel conditions that pose a high risk of future extreme wildfire behavior would persist over most of the project area. Potential long-term effects to the species and habitats analyzed in this report would, therefore, be similar to those described for no action in the areas not treated.

All other effects of Alternative 3 are discussed above under Effects Common to Alternatives 2 and 3.

Summary Determinations

Aquatic Species Habitat

Activities proposed under the action alternatives would have an overall neutral effect on aquatic habitat indicators. These actions are not expected to introduce measurable instream fine sediment into perennial stream reaches where aquatic species of concern occur. Baseline conditions for all instream habitat elements would be maintained including substrate character, embeddedness, pool frequency, pool quality, width to depth ratio, and streambank condition.

There are no expected measurable changes to physical channel or habitat conditions from the activities proposed under either action alternative including water quality, flow hydrology, and riparian reserve function. The long-term trend would be a slight improvement in overall riparian and aquatic conditions in the analysis area because of the reduced threat of high severity wildfire in the watersheds. The proposed treatments would reduce the severity of effects to aquatic habitats from a future wildfire, should it occur, and would result in reduced future cumulative

effects from potential high severity fires. This benefit would be greater under Alternative 2 than Alternative 3 because Alternative 2 would treat more acres.

Sensitive Species

For the reasons discussed above, Alternatives 2 and 3 may impact individuals but would not cause a trend towards federal listing or a loss of viability for hardhead, black juga, California floater, nugget pebblesnail, or scalloped juga.

Management Indicator Assemblages

As noted above, neither action alternative would be likely to cause any meaningful change to population trends or habitat availability for largemouth bass or rainbow trout; therefore, no adverse effects to inland warm water or inland cold water assemblages would be expected to occur.

Recreation, Scenery and Special Uses[50]

The cumulative effects analysis area for recreation is defined by the outer extent of the 6th field (HUC 6) watersheds that comprise the project area. This effects analysis area takes into consideration the potential effects from this project and their relationship to recreation and special uses – which are influenced by visual quality – within and adjacent to the project area (e.g., as seen from Shasta Lake).

The time period for measuring cumulative effects is 20 years from the completion of implementation or, in the event that the No Action alternative is selected, 20 years from the date of decision. This is the amount of time that the proposed fuels treatments are deemed to be effective (see the Wildfire and Fuels discussion above).

Recreation

Affected Environment

The Shasta Unit of the Whiskeytown-Shasta-Trinity NRA and the surrounding forest that encompasses the project area is one of the most frequented outdoor recreation sites in California. Boating, camping, hiking, fishing and hunting are common activities on these public lands. During the summer high use period facilities are generally filled to capacity with an excess of 1 million person/visitor days per year recorded. Up to 80 percent of the visitor use occurs between the Memorial Day and Labor Day weekends. Lake level is a strong component of visitor use in the latter portions of the season but, during years with particularly low water yield, it can be a factor throughout the year – with some visitor facilities closing due to lack of lake access.

The Recreation Opportunity Spectrum (ROS) is a continuum of recreation opportunity settings. A recreation opportunity setting is a combination of physical, biological, social, and managerial conditions that give value to a place. The ROS assumes that recreationists seek a range or spectrum of recreational opportunities from the highly constructed and interactive to the natural and solitude-oriented. The project area encompasses the following ROS classes: Semi-Primitive Non-motorized, Semi-Primitive Motorized and Roaded Natural.

[50] The Recreation, Scenery and Special Uses section of this DEIS summarizes information contained in the Green-Horse Recreation, Scenery and Special Uses Report. The report is incorporated by reference and is part of the project planning record located at the Shasta Lake Ranger Station.

The Pit, Squaw Creek, and McCloud Arms of Shasta Lake are immediately adjacent to the project area and represent a significant portion of the lake. A high volume of visitor use occurs on this portion of the lake, primarily in the lower stretches of these arms centered between Holiday Harbor Marina-Bridge Bay-Jones Valley. Recreational use of the lake becomes dramatically less in the upper reaches of these arms (USDA Forest Service 2014).

Use of houseboats occurs frequently in the eastern half of Shasta Lake, although smaller watercrafts also use the lake and upstream tributaries. Lake use is a year-round occurrence, with most visitor days occurring during the summer months (between Memorial Day weekend and Labor Day). The quality of boater experience is considered high with satisfaction levels rated across varying boater uses and encounter types (Graefe et al. 2005).

There are only two developed recreation sites in the project area (Greens Creek and Chirpchatter campgrounds). However, many others are in close proximity and are likely to be influenced by project activities. These include the following:

Hirz Mountain Lookout

Hirz Bay Campground

Hirz Bay Boat Launch

Dekkas Rock Campground

Lakeview Marina (closed)

Holiday Harbor Marina

Bailey Cove Trail

Bailey Cove Boat Launch

Bailey Cove Campground

Ski Island Campground

Mariners Point Campground

Bridge Bay Marina

Silverthorn Resort and Marina

Jones Valley Resort and Marina

Upper Jones Valley Campgrounds

Lower Jones Valley Campground

Jones Valley Boat Launch

Arbuckle Flat Campground

Madrone Campground

Clikapudi Trail

Many other recreation sites on private property are also likely to be influenced due to their proximity to the project area.

Fire, forest closures, fire and fuels management activities can all have significant impacts on the recreational use of National Forest lands (Starbuck et al. 2006). In spite of fire exclusion efforts, the project area and Shasta Lake in general have experienced increases in accidental fires associated with recreational activities and in arson near human developments. Fire exclusion near these developments often causes increases in tree and shrub density (USDA Forest Service 2009b). The Shasta Lake Ranger District experiences a large number of wildfire ignitions annually; of these approximately 81 percent are human-caused (USDA Forest Service 2013). The high level of visitor use – and the accompanying risk of human-caused ignitions, when combined with current fuel conditions, increases the risk of large, high-severity fires within the project area.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects

Under this alternative, visitor use would likely continue with trends seen in the recent past. ROS levels would be maintained at current values with semi-primitive motorized and roaded natural appearances. Because perpetuation of the current high fuel loads increases the risk of future widespread, high-severity fires, the risk of disruption to recreational pursuits in the project area during future fire events also increases. Such disruption may include protracted periods of smoke disturbance as well as noise disturbance and area closures for public safety during fire suppression efforts.

Cumulative Effects

When no action is combined with ongoing fire suppression efforts and associated effects, the already high likelihood of a high severity fire would continue to increase. Such a fire could adversely affect recreation attributes and opportunities in the project area. Fire and forest closures can have significant impacts on the recreational use of public lands. Fire may also change the successional path of the ecosystem over time, which alters the physical site attributes that are a function of a recreation demand (Starbuck et al. 2006).

A major wildfire could potentially destroy or damage camp sites and trailhead signage and deposit barriers across trails (e.g. downed trees and/or landslides), thus limiting recreational access. Additionally, the high risk of wildfire occurring with the current conditions of heavy downed fuels and an understory of dense vegetation poses a potential danger to the health and safety of forest visitors. Safety and health concerns could diminish the recreational use experience. Forest visitors may also change their use patterns in response to a large wildfire event. Repeat visitors may seek alternative recreation sites outside the project area resulting in long-term reductions in recreation use.

Recreational use in areas with high fire risk increases the likelihood of human-caused ignitions. As previously noted, approximately 81 percent of ignitions around Shasta Lake are human-caused (USDA Forest Service 2013). The effects on recreation settings of a major wildfire in the short- and long-term are considered to be adverse. Work done by Starbuck and others (2006) has shown a negative response by recreational users when asked to comment on forest visit experiences in areas that have had catastrophic fire. The same study concluded that catastrophic burns decrease trips taken and that areas that have previously suffered catastrophic burns also see a decrease in recreation visits (Starbuck et al. 2006). The Jones and Bear fires that occurred adjacent to the project area have greatly reduced visitor use experiences in the Jones Valley area and have created several recreation-related issues for land managers (Grigsby 2010 personal communication).

Whether a major wildfire affects recreational experiences depends upon the visitor and the types of experiences that they are seeking. Such a fire could have both short- and long-term major adverse effects on a direct nature experience. Major wildfires may also cause even fewer visitors to recreate in the forest for several years following the fire event, resulting in a negative effect.

In the aftermath of a large high-severity fire the project area would likely not meet current Forest Plan ROS class requirements – and may not for many decades post-fire:

- due to the unnatural scenic character of a fire outside the historic range of variability, and
- to the extent that recreation facilities (e.g. trails and campgrounds) and other related resources (e.g. roads, trailheads, etc.) are adversely impacted.

Alternative 2 – Proposed Action (Revised)

Direct and Indirect Effects

Recreation Opportunity Spectrum (ROS) values may be diminished for a short period but would likely improve considerably over the long term. Because prescribed fire closely resembles natural fire in a historic context, the effects would be difficult to distinguish from naturally occurring fire within a historic range of variability.

Fire can be a danger to public health and safety for visitors to the project area. Provided that prescribed burning is contained to designated areas, risk would be greatest to users of areas in close proximity to where prescribed fire is being applied. Additionally, recreationists using off-trail portions of the project area (e.g. hunters) could be affected by area closures. Scheduling of prescribed fire treatments may overlap with peak hunting season (late September to early November).

Smoke from prescribed fire operations is likely to be the largest impact to recreation activities. Air quality restrictions and the application of smoke management principles (design features AIR-1 and AIR-2) would reduce these effects. Periods of visible smoke would likely be of short duration but could have moderate effects to visitor use in and surrounding the eastern portion of Shasta Lake.

Thinning activities, which would be conducted outside of the peak visitor use season (design feature REC-2), would cause a localized disturbance to forest users. The disturbance would be of short duration with only minor impacts.

The perceptions of visitors to natural recreation areas concerning fire management actions (such as this project) may depend on a number of variables, including attachment to a given site and opportunities presented to them to educate and familiarize themselves with land management practices (Hendricks et al. 2008). The results of one study conducted on visitors to the Big Sur region of California indicated that a majority of those visitors were not aware of fire regulations or evidence of fires (Hendricks et al. 2008). However, visitors with higher levels of place attachment continuously exhibited higher levels of perceived constraints and observations of fire conditions (Hendricks et al. 2008).

Another study of visitors to the San Bernardino National Forest found that, on average, forest visitors trusted the Forest Service's management of forests and believed in their ability to effectively manage wildland fires (Absher et al. 2008).

Starbuck and others (2006) developed modeling based on data collected in New Mexico during the 2000 and 2002 fire seasons to simulate the linkages from fire and fuels management activities to changes in forest recreation demand, and ultimately to regional economic impacts. The modeling predicted that hazardous fuels reduction resulting in primarily low-intensity/low-severity fire and forest restoration activities were likely to be viewed by recreation users as increasing the quality of a recreation site (and were not likely to decrease recreation use). Conversely, the modeling predicted a decrease in trips taken to areas that suffered a catastrophic burn and where no forest restoration activities were undertaken (Starbuck et al. 2006).

Implementing prescribed fire would maintain or encourage ecological characteristics – such as large trees, open forest structure and reduced understory vegetation and downed material – over much of the project area. These characteristics have been shown to be favored by forest recreationists (Gobster 1994). This would enhance the recreation experience in the long term, particularly with respect to "nature encounters" (e.g. increased opportunities to observe wildlife) and enjoyment of late-successional forest characteristics such as large trees. Additionally, prescribed fire would increase the quality of browse in the project area for species such as deer, which would benefit hunting experiences.

Cumulative Effects

As discussed in the Wildfire and Fuels section of this chapter, Alternative 2 would significantly decrease the risk of future large, severe wildfires. This in turn would support and encourage continued recreational use of the project area and reduce the threat from human-caused ignitions. The recreational experience would be maintained or enhanced under this alternative with improved environmental conditions favored by forest visitors.

The Bureau of Reclamation (BOR) proposal to raise Shasta Dam and enlarge Shasta Lake reservoir is a foreseeable action. However, Alternative 2 would not add to any future displacement of recreation in the project area from the BOR project. Any adverse effects of the Green-Horse Project on recreation in the project area would be temporary and would likely have dissipated by the time the BOR project is implemented.

Possible future growth of the communities in northern California is likely to increase the demands on the project area for recreation opportunities. Higher visitor levels would increase the potential for accidental wildfires. With implementation of this alternative, the potential that a human-caused ignition would develop into a widespread, high-severity fire would be reduced. This would result in long-term major beneficial effects on both the recreation setting and experience. Safety issues related to a high-severity fire would also be reduced or minimized. Smoke impacts during future wildfires would be reduced (see the project Air Quality report in the project file), as would the risks to forest visitors. Reducing periods of poor visibility and poor air quality during wildfire events would reduce the impacts to visitor use during these periods.

Alternative 3 – No Forest Plan Amendment

Direct, Indirect and Cumulative Effects

Aspects of the discussion that apply to Alternative 2 apply to this alternative but are reduced in scale due to a significant decrease in the acreage of proposed treatments in proximity to recreation sites and areas of high visitor use. The effects are similar to Alternative 2; however, only a handful of developed sites would likely be affected (Madrone Campground and Arbuckle Campground). While the effects in the treated areas are the same as disclosed for Alternative 2, in areas that remain untreated the effects would resemble those disclosed under the No Action alternative.

Scenery

Analysis of visual quality was conducted using the methods found in Agriculture Handbook 462 – National Forest Landscape Management Volume 2 (USDA Forest Service 1974)[51] and incorporating the concepts of scenic attractiveness and scenic integrity in the more recent Agriculture Handbook 701 – Landscape Aesthetics: a Handbook of Scenery Management (USDA Forest Service 1995b).[52]

Affected Environment

The project area is within the Sierra-Cascade Landscape Province Character Type − as defined by the Visual Management System (USDA Forest Service 1974). The province is characterized by mixed topography of varying aspects, steepness and ridge orientation formed by two significant mountain ranges intersecting through the province. The project area is representative of the province's defined character and is further enhanced by the presence of Shasta Lake. The forest is comprised of mixed conifer stands (e.g. Douglas-fir, Sierran mixed conifer, red fir, ponderosa pine) with variable understory (e.g. Oregon grape, deer brush, bitter cherry, coffee berry, etc.), hardwood (e.g. black oak, madrone, tanoak, live oak) species and extensive montane chaparral brush fields (e.g. green leaf Manzanita, white leaf Manzanita, canyon oak and chamise). See the Vegetation section of this chapter for further characterization of vegetation within the project area.

Although there are no sensitive travel corridors within the project area, Interstate 5 (I-5) to the west provides intermittent views of the westernmost portion of the project area. The project area, mostly located within the Whiskeytown-Shasta-Trinity National Recreation Area (NRA), carries the Visual Quality Objective (VQO) of Retention or Partial Retention, which corresponds to the respective scenic integrity levels of High and Moderate. See figure 3-7 below.

The project area currently meets the assigned VQOs and is characterized by a mixture of scenic variety and attractiveness classes. Some areas, particularly along the Gray Rocks and Devils Rock-Backbone, are scenic attractiveness Class A – Distinctive and have a Very High scenic integrity level. Other areas are characterized as Class B (Typical) or Class C (Indistinctive). A mixture of variety classes (Distinctive, Common and Minimal) can also be found (Joyce 2011 personal communication). However, several visual components adjacent to the project area have been negatively affected by past wildfires. Much of the Jones Valley area burned in 1999 with high vegetation severity and left the affected landscape devoid of trees and with dense concentrations of snags and downed logs.

[51] Describes and provides guidance for managing scenic resources following the Visual Management System based on Visual Quality Objectives (VQOs) assigned by the Forest Service.
[52] Describes and provides guidance for managing scenic resources following the Scenery Management System based on categories of Scenic Attractiveness and Scenic Integrity assigned by the Forest Service.

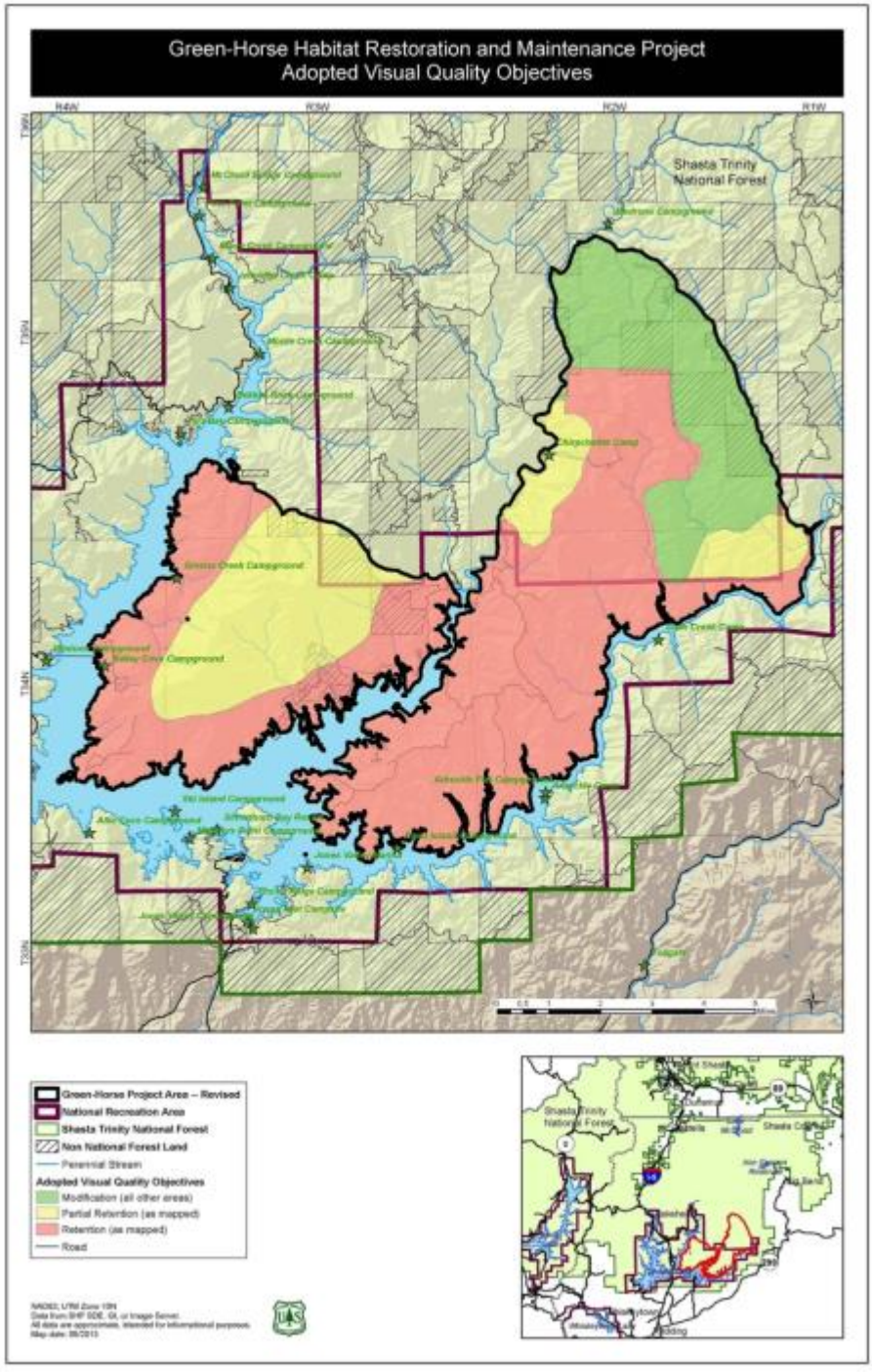

Figure 3-7 Forest Plan Visual Quality Objectives (VQOs) – Green-Horse project area

Although fire is a natural component of the ecosystem, recent extreme fire behavior when compared to what historically occurred has resulted in uncharacteristically large expanses of severely burned vegetation in many portions of the Shasta-Trinity National Forest. Current fuel conditions in the project area increase the risk that future wildfires will be widespread with high vegetation severity (see the Wildfire and Fuels and Vegetation sections); widespread, severe fire effects are generally considered undesirable from a visual quality perspective (Starbuck et al. 2006).

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects

The no action alternative would have no direct effects on visual quality. Recent trends in visual quality would likely continue. VQOs would – at least in the short term – be maintained at current values of retention and partial retention in the project area and corresponding Scenic Integrity Levels would continue to exist except where significant disturbance has occurred (e.g., Jones Valley).

Indirectly, the no action alternative would perpetuate a forest condition of dense vegetation. This condition would provide low visual diversity and would also inhibit the sight distance of the viewer, resulting in a less interesting visual experience. Dense and homogeneous landscapes have been shown to have low scenic quality (Ryan 2005).

Cumulative Effects

This alternative would not address the current high fuel levels and – when combined with the ongoing agency policy of fire suppression – would increase the risk of a large-scale, high-severity fire. Modeling predicts that, in the event of such a fire, up to 68 percent of the project area would experience high vegetation fire severity (see table 3-12 above). This would result in an uncharacteristically large expanse of charred or dead trees, denuded vegetation, and residual debris. High-severity fire effects have been repeatedly shown to elicit negative responses from the recreating public (Winter and Knap 2008). These visual effects could persist perhaps for decades, until the forest overstory in the affected areas regains dominance over understory vegetation.

Additionally, in the event of a large-scale fire, impacts to visual quality from protracted periods of smoke and poor air quality would be short-term and moderate- to- major. Persistent temperature inversions during times of atmospheric stability could trap smoke over large areas (as in the 1987, 1999, and 2008 wildfires that adversely affected the Redding area), limiting middle ground and background views.

The occurrence of a large-scale, high-severity wildfire would affect visual quality attributes related to vegetation and scenic beauty within the project area. Visitors may seek alternative recreation sites outside the project area, resulting in long-term reductions in recreation use.

The effects on the scenic settings associated with the project area, and of Shasta Lake in general, from a major wildfire would be adverse to both short- and long-term VQOs and Scenic Integrity Levels. These effects would likely occur on a large scale and would likely be quite noticeable even to the casual forest visitor, as evidenced by conditions following the Bear and Jones fires in Jones Valley (see figure 3-8 below).

Figure 3-8. The 2004 Bear Fire in Jones Valley – three years post-fire

Alternative 2 – Proposed Action

Direct and Indirect Effects

Modeling predicts approximately 91 percent of either unchanged or low vegetation fire severity from implementation of this alternative (see table 3-13 above), with scattered areas of moderate to high vegetation fire severity.

Temporary reductions in VQOs and related Scenic Integrity Levels may occur for a short period of time but would likely improve considerably over the long term. Because prescribed fire closely resembles the natural role of fire in a historic context, its effects would be difficult to distinguish from those of naturally occurring fire. In studies conducted by Winter and Knap (2008) recreationists on public lands were generally not surprised or bothered by smoke or fire-damaged vegetation, and they generally supported prescribed fires in forested areas that had been thinned or cleared to reduce fire danger.

Degradation in visual quality would be most visible in areas where forest canopy cover is limited (such as brush fields). In addition, smoke impacts during and immediately following project implementation could hamper middleground and background views. These effects would be short-lived (less than 1 year) and would be reduced by design features (VIS-1a and VIS-1b) that would regulate the amount of contiguous area treated at any one time.

Overall reduction in VQOs is not predicted to occur, given the size of the viewshed and the nature of effects produced by prescribed fire as evidenced by similar projects around Shasta Lake (see table A-1 in Appendix A). The prescribed fire would cause the charring or blackening of some trees to varying extents throughout the project area. Starbuck and others (2006) have shown that low-intensity burns yielded a slight increase in visits (correlating to favorable scenic quality) when compared to an untreated landscape.

The removal of some of the dense understory through prescribed burning would allow visitors to see further into the forest – allowing for more varied foreground and middleground views. More forest openings would also enhance visual diversity in form, color, texture, and scale which is seen as more interesting or visually desirable than a homogeneous landscape. Studies have shown that desirable aesthetic effects are created and sustained through fuels reduction treatments such as prescribed fire (Kaplan and Kaplan 1989, Ryan 2005).

Prescribed fire operations would take advantage of existing or naturally occurring fuelbreaks to limit the spread of fire and to encourage a natural look. Approximately 4.61 miles of dozer line would be constructed, but this would occur in areas with significant canopy cover and would not be visible from the lake. The dozer lines would be constructed to reduce their visibility from roads.

Hand thinning, pruning piling and pile burning would be limited to areas adjacent to private property boundaries, recreation residence tracts and around bald eagle nest sites. A temporary reduction in the immediate foreground at the site would occur because of the existence of piled material and small, low-cut stumps. After the debris is removed (through pile burning), visual quality would be expected to increase due to the reduction in understory vegetation and improved viewing distances, as suggested by Ryan and others (Ryan 2005). The proposed hand treatments would be conducted outside of peak visitor season (design feature REC-2), so the resulting disturbance would have only minor effects to visitors' visual experience.

Implementing fuel reduction through prescribed fire would maintain or encourage conditions favored by forest visitors for scenic beauty (e.g., large trees, open forest structure, reduced understory vegetation and downed material) over much of the project area (Gobster 1994). This would enhance the public's experience, particularly with respect to "nature encounters" (e.g., increased opportunities to observe wildlife) and enjoyment of late-successional forest characteristics such as large trees.

Generalized values of scenic beauty would be reinforced through this alternative by creating and sustaining a complex viewshed with diverse vegetation stratification (age class and type) (Kaplan and Kaplan 1989) visualized by texture, color, sight penetration and pattern. Modeling by Ribe (1990) demonstrates that following prescribed fire, increases in herbaceous plants and wildlife sightings would occur, resulting in visually preferred conditions.

Cumulative Effects

Implementation of Alternative 2 would significantly decrease the risk of future large, severe wildfires in the project area. Modeling predicts that approximately 87 percent of the project area would experience either unchanged or low vegetation fire severity from a wildfire occurring under 90th percentile weather conditions following completion of project activities (see table 3-14 above). The proposed treatments would promote a landscape that is more resilient to significant change through wildfire disturbance and would, in turn, moderate the potential for extreme detrimental changes in visual quality in the eastern portion of Shasta Lake.

The cumulative effects of Alternative 2 on visual quality, when combined with reasonably foreseeable actions, would depend upon mitigations implemented with those actions and their visibility from the project area. This is especially important in the context of viewsheds – such as from the lake itself – where vast expanses are visible at any one time and the negative effects caused by large, high-severity wildfires that can affect a substantial portion of a viewshed in a single event.

The cumulative changes related to reasonably foreseeable actions would have minimal impact to visual quality, assuming that reasonably foreseeable actions visible from the project area are consistent with standards and guidelines from the Forest Plan and the stated VQOs.

The Bureau of Reclamation (BOR) proposal to raise Shasta Dam and enlarge Shasta Lake reservoir is a foreseeable action. However, Alternative 2 would not add to any future effects to visual quality from the BOR project. Any adverse effects of the Green-Horse Project on visual quality in the project area would be temporary and would likely have dissipated by the time the BOR project is implemented.

Cumulative effects on visual quality would also depend upon short- and long-term management actions to maintain the reduced fuel loads following project implementation. Cumulative changes to visual quality in the project area would be minimal assuming that future projects would be consistent with Forest Plan Standards and Guidelines and that VQOs and current Scenic Integrity Levels would be maintained. Figures 3-9 and 3-10 below illustrate the range of visual effects predicted under Alternative 2.

Figure 3-9. Portion of Green Mountain Prescribed Fire Project - three years post-burn

Figure 3-10. Portion of Green Mountain Prescribed Fire Project - four years post-burn

Alternative 3 – No Forest Plan Amendment

Most effects of Alternative 2 also apply to this alternative but are reduced in scale due to a significant decrease in the acreage of proposed treatments within or close to recreation sites and areas of high visitor use.

Direct and Indirect Effects

Modeling predicts that vegetation fire severity would be unchanged to low over 98 percent of the treatment area from implementation of this alternative (see table 3-14 above). Most high visitor use areas would not have scenic impacts from treatment under this alternative, and few of the prominent viewpoints affected under Alternative 2 would likely be affected under this alternative. Some of the remaining points of interest for visual quality include Arbuckle Flat Campground, Madrone Campground Fenders Ferry bridge/FS road 34N17 and the upper reaches of the Pit Arm of Shasta Lake.

Cumulative Effects

Modeling predicts that approximately 48 percent of the project area would experience either unchanged or low vegetation fire severity and up to 50 percent high vegetation fire severity from a wildfire occurring under 90th percentile weather conditions following completion of project activities (see table 3-15 above).

Cumulative effects to visual quality are, therefore, similar to those of Alternative 2 in the treated areas (see figures 3-9 and 3-10 above), and similar to those of Alternative 1 (no action) in the areas that remain untreated (see figure 3-8 above).

Special Uses

The Shasta Unit of the Whiskeytown-Shasta-Trinity NRA has authorized a wide range of special use activities and facilities in support of public recreation, including socio-economic interests.

Few areas in the National Forest System have such a high concentration of special use authorizations.

Affected Environment

Special use permittees operating within and adjacent to the project area vary greatly but can be divided into two main groups: businesses and personal use.

Permits authorizing personal use of public lands cannot be utilized for commercial purposes and are limited to recreation residences, private boat moorages and registrations for privately-owned houseboats. Five marina/resorts (Bridge Bay, Holiday Harbor, Lakeview [closed], Silverthorn and Jones Valley), three recreation residence tracts, Shasta Caverns, and other recreation-related enterprises occur within the analysis area for special uses.

The recreation residence program was initiated in the 1920s to encourage recreational use of public lands (Ryan 2005). The residences are owned by private individuals, and a long-term permit is issued for the sites they occupy. The three recreational residence tracts within the analysis area include the Campbell Creek Tract on the McCloud Arm, the Didallas Tract on the Squaw Creek Arm and the Silverthorn Tract on the Pit Arm of Shasta Lake. Together, there are 109 private residences. As many as 2,800 moorage slips are authorized by the Forest Service, and about 650 privately owned houseboats are registered on Shasta Lake.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects

Implementation of no action would have no direct effects on special use permit holders. The socio-economic relationship between the project area, the eastern portion of Shasta Lake and visitor use that results in revenue would likely follow recent trends.

However, fuels in the project area would continue to accumulate and understory growth would proliferate, which would increase the risk that future wildfires would be widespread and severe (see the project Fire and Fuels Report). Such fires could imperil buildings and other infrastructure associated with special uses in the project area.

Cumulative Effects

When no action is combined with ongoing fire suppression efforts and associated effects, the already high likelihood of a future widespread, high-severity fire would increase (see the Wildfire and Fuels discussion above). Such a fire could have negative effects on permit holders and the recreation industry associated with the project area and Shasta Lake in general. A high-severity fire would lead to area closures, poor air quality conditions and detrimental effects to natural resources. This would reduce the desirability of recreating in the area and lead to lost revenue for special use permittees and loss of interest in using personal permitted recreation opportunities (e.g., privately-owned houseboats and recreation residences).

A major wildfire would have both short- and long-term effects. The effects of smoke and the risks posed by wildfires would be generally short-lived and confined to the season in which they occur. Adverse effects to natural resources, however, could be evident for many decades – depending on site-specific conditions and on post-fire rehabilitation efforts. In addition, area closures to protect forest visitors or to prevent further resource damage could extend for many

years. These consequences would adversely impact potential business and recreational enjoyment of project area permittees. The Jones Valley area along the south shore of the Pit Arm of Shasta Lake experienced such adverse impacts following two significant wildfires.

Catastrophic forest fires in the recent past have increased the public's awareness of wildland fire and the detrimental effects caused by these events (Ryan 2005). Fuels reduction projects around Shasta Lake (Bear Hazardous Fuels Reduction Project, Northwoods Hazardous Fuels Project, Lakehead Community Fuels Reduction Project and others) have been successful in reducing the effects of high-severity wildfire (Boyer 2011 personal communication); however, conditions that are not spatially limited (e.g., smoke) may still affect recreation use and permits.

Alternative 2 – Proposed Action (Revised)

Direct and Indirect Effects

The proposed treatments under Alternative 2 would reduce the potential for high-severity fire across the project area. This would enhance the long-term enjoyment of the recreating public and encourage continued use of the area. It would also enhance business for commercial permit holders and provide safe, high quality use for personal permittees.

During periods when prescribed fire is being applied, temporary, short-duration effects could be negative in areas near or where implementation occurs. Such effects would likely last a few hours to a few days and would occur outside of peak visitor use periods. The intensity of effects would likely be minimal to moderate and would be managed through design features and related guidance. Area closures for public safety may be needed during and immediately following implementation; closures would be limited to the areas treated and would be of short duration.

Smoke from prescribed fire operations would likely be the greatest impact to activities associated with special uses. Air quality restrictions and the application of smoke management principles (as described in the project Air Quality Report) would reduce these effects. Effects are likely to be of short duration but could have moderate effects to visitor use in the eastern portion of Shasta Lake, resulting in minor impacts to special use permits outside of peak season.

The proposed thinning activities, when conducted outside of peak season, could cause localized disturbance to permittees and their customers. These disturbances would be of short duration with only minor impacts. Project design features, which include coordination with cooperators and special use permit holders and public notification (SUP-1), would reduce the adverse effects.

During implementation of this alternative, additional revenue would be produced through supplies and services provided by commercial permit holders. Boat rentals, fuel, moorage and other supplies and services could be obtained from existing special use permittees. Additional revenue would be generated in the local economy through the implementation of prescribed fire and thinning activities such as equipment rental, fuel, lodging and food and other general supplies and services commonly procured during prescribed fire operations.

Cumulative Effects

As discussed in the Wildfire and Fuels section of this chapter, this alternative would significantly decrease the risk of future large, severe wildfires. Use of the project area associated with special use permits and related revenue earnings would likely be maintained or enhanced under this alternative.

The reduced risk of high-severity fire would likely sustain visitor use and corresponding revenues at or above current levels. As discussed in the effects analysis for recreational use (above), the proposed treatments would promote a landscape favored by forest visitors and would, therefore, encourage return visits.

The Bureau of Reclamation (BOR) proposal to raise Shasta Dam and enlarge Shasta Lake reservoir is a foreseeable action. However, Alternative 2 would not add to any future displacement of special uses in the project area from the BOR project. Any adverse effects of the Green-Horse Project on special uses in the project area would be temporary and would likely have dissipated by the time the BOR project is implemented.

Alternative 3 – No Forest Plan Amendment

Most of the high visitor use areas and many of the commercial special use sites within the analysis area would not be notably impacted by fuels reduction treatments under this alternative. Customers of these permit holders do not frequent the areas that would be treated as often as other locations within the project area. The recreation residence tracts at Campbell Creek would not be treated under this alternative and while they would experience no direct impacts, they would not reap the benefits of fuels reduction described under Alternative 2. In addition, few privately-owned houseboats frequent areas on the lake that could be impacted by this alternative.

While many of the effects of Alternative 2 also apply to Alternative 3, they are reduced in scale due to a significant decrease in treatment acres and the distance of the treatments from the recreation residences and other areas of high visitor use. The direct, indirect and cumulative effects to special uses are similar to those of Alternative 2 in the areas treated; however, few commercial permit holders and their customers would be affected, and any effects would be virtually unmeasurable. In the untreated areas, the effects would be similar to those of Alternative 1 (no action).

Cultural Resources[53]

The cultural resource analysis addresses the potential effects to cultural (heritage) resource sites of the alternatives and compliance with the National Historic Preservation Act. The cumulative effects analysis area is the project area; the temporal boundary for cumulative effects analysis is the project implementation period (7 to 10 years) or, in the event the No Action alternative is selected, a period of ten years after the Record of Decision is signed.

Affected Environment

A total of 19 known cultural resource sites occur in the project area. Of these 19 sites, 14 are prehistoric, four are historic, and one is a multicomponent site consisting of both historic and prehistoric resources. Of the 19 sites within the project area, one prehistoric site has been determined eligible for the National Register of Historic Places (NRHP) and one historic site has been determined ineligible; the other 17 sites remain unevaluated for NRHP potential. Most of the known sites in the general vicinity are located below the high water line of Lake Shasta and are therefore outside of the project area.

[53] The Cultural Resources section of this DEIS summarizes the Green-Horse Cultural Resources Assessment. The report is incorporated by reference and is part of the project planning record located at the Shasta Lake Ranger Station.

Environmental Consequences

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

Implementation of the no action alternative would have no direct impact on any known cultural resources. However, under this alternative no surveys would be conducted to locate and identify any previously unrecorded sites, as would occur under either action alternative. Indirectly, this alternative would increase the risk of widespread, high-severity fires, which could potentially burn historic resources (see the Wildfire and Fuels section of this chapter). Because no surveys would be conducted under this alternative, no protective measures could be taken for currently unidentified cultural resources within the project area in the event of a wildfire.

Fuels would continue to accumulate under this alternative and – when combined with ongoing fire suppression – could result in a high severity wildfire, which could potentially burn historic resources within the project area or expose them to human disturbance through removal of protective vegetation cover.

Effects Common to Alternatives 2 and 3

Direct and Indirect Effects

Although project design features would be implemented to protect any at risk eligible or unevaluated sites, potential minor, moderate or major impacts may include:

- Stratigraphic disturbance of previously unknown archaeological sites as a result of digging handlines or using ground based equipment, and
- Burning of historic structures in the event that fuels reduction burning activities accelerate out of control.

In order to avoid the potential for adverse effects to historic properties associated with the implementation of the action alternatives, the project design features described in Chapter 2 (ARCH-1 through ARCH-4) would restrict any project activities that would adversely impact known cultural resources. As a result, either action alternative would be implemented in accordance with the Regional Programmatic Agreement therefore the NHPA and all other laws pertaining to cultural resources, and would have the potential for only negligible or minor direct impacts to known cultural resources.

Indirectly, increased artifact visibility and accessibility following the implementation of prescribed fire activities could result in minor, moderate or major impacts to cultural resources associated with the potential for looting within the treated areas. Because the proposed prescribed fire is predicted to be of mostly low to moderate severity (see the Wildfire and Fuels discussion above), the risk of exposure to human disturbance from project implementation would be less under either action alternative in the treated areas than under no action in the event of a future widespread, high-severity fire.

Cumulative Effects

Implementation of either action alternative could result in long-term beneficial impacts to cultural resources by reducing the risk of widespread, high-severity wildfires in the areas treated, which could potentially burn historic structures or expose them to human disturbance by removing protective vegetation cover.

Alternative 2 – Proposed Action (Revised)

Direct and Indirect Effects

All of the 19 known cultural sites that occur within the project area may be impacted by implementation of this alternative. In addition, currently unidentified cultural resources within the project area may be directly impacted. Project design features would reduce the risk of impacts from project activities.

Cumulative Effects

Many of the 19 known cultural sites affected by this alternative were likely impacted by the Bear Fire. In addition, two previous vegetation projects and two fuels projects have occurred within the project area. Furthermore, seven of the 19 known sites would potentially be inundated if a proposed Bureau of Reclamation project that would raise Shasta dam by as much as 18 feet is implemented.

Alternative 3 – No Forest Plan Amendment

Direct and Indirect Effects

Under this alternative, a total of five known cultural sites may be impacted in addition to any currently unidentified cultural resources within the project area. Of these five sites, four are prehistoric sites consisting of surface scatters of lithic scatters and/or groundstone and one is a historic site. The historic site has been determined to be ineligible for the NRHP, but the four prehistoric sites remain unevaluated. None of the four prehistoric sites are located in areas that have been impacted by known previous fires; accordingly, all would be protected by the proposed project design features in accordance with the Programmatic Agreement Heritage Program Manager.

Cumulative Effects

Many of the five known cultural sites affected by this alternative have likely already been impacted by the Bear Fire. None of the five known sites would be inundated by the Bureau of Reclamation's proposed raising of Shasta dam by as much as 18 feet.

While this alternative would reduce current fuel accumulations and would moderate future fire severity on the treated acres, this potential benefit to cultural resources would be less than under Alternative 2, because most of the project area would remain untreated.

Non-Significant Forest Plan Amendment

Forest Service Handbook (FSH) 1909.12.25.4 (USDA Forest Service 2006) provides direction on project-level Forest Plan amendments and is the basis for this section.

As described in Chapter 2, Alternative 2 proposes amending minimum Forest Plan requirements for dead and down material in the Limited Roaded Motorized Recreation and Roaded Motorized Recreation management prescriptions. Current minimum dead and down material requirements for these two prescriptions are 20 tons per acre and 10 tons per acre, respectively.

Soil scientists agree that soil cover should be maintained at levels that sustain soil productivity and that do not elevate wildfire risk and severity – and the resulting detrimental effects to soils. In dry environments biological decay is limited, which allows accumulation of dead and downed

material. Fire plays an important role in recycling nutrients in the debris. However, increased fire intensity quickly reduces available nitrogen in soil (Bormann et al. 2008).

Localized site conditions present two issues with the current standards for dead and down material in these management prescription areas. In the majority of these administrative areas the standards are currently not met and are highly unlikely to be met even without fuels treatments. Treating dead and down material to reduce fire risk and fire hazard would further trend these areas away from Forest Plan standards. Even so, in these areas – as well as in areas where Forest Plan standards are currently met – the current fuel conditions pose a risk of detrimental effects to soils and other project area resources in the event of a wildfire.

The portions of the project area encompassed by these two management prescriptions are characterized by wide range of vegetation types that historically supported a range of down wood levels. Several fire and fuels specialists recommend a spectrum of down wood levels based on vegetation type and fire regime (Harmon 2002, Brown et al. 2003). Other researchers describe the difference between current and historical down wood conditions prior to fire suppression and active land management (Stephens et al. 2007, Wright et al. 2002), and the influence of down wood levels on recent fire behavior (Knapp et al. 2005, Saab et al. 2006, Uzoh and Skinner 2009). See the Fire and Fuels Report in the project record for a detailed discussion of the findings of these peer-reviewed publications.

Based on the above findings, and in consideration of the needs of project area resources, we propose to amend the Forest Plan minimum dead and down material requirements in these two management prescriptions to between 5-15 tons per acre.

The three key resource areas that would be affected by the proposed Forest Plan amendment for dead and down materials are wildfire and fuels, soil and wildlife. The effects of the proposed amendment on those resources are discussed in detail in the project specialist reports and summarized below:

- Implementing **Alternative 1** would pose a high risk of future high-severity fire and its detrimental effects to soil productivity and wildlife habitat.
- Amending the Forest Plan as proposed under **Alternative 2** would enable us to achieve the stated fuel reduction objectives while protecting soil productivity and providing for wildlife habitat needs.
- Implementing prescribed fire without the proposed Forest Plan amendment under **Alternative 3** would preclude treatment of over two-thirds of the project area (see the Wildfire and Fuels section); the benefits of fuel reduction related to future fire behavior and severity, soil productivity and wildlife habitat would likely be limited to those areas treated.

Climate Change

Ongoing climate change research has concluded that, on a global scale, climate is changing; that the change will accelerate; and that human greenhouse gas emissions – primarily carbon dioxide (CO_2) and methane (CH_4) emissions – are the main source of accelerated climate change (USDA Forest Service 2009a, U.S. Environmental Protection Agency [EPA] 2010). Climate change models and the predicted effects on different regions around the world show wide variation, with some regions greatly affected while others less affected. Regional trends over the last century are linked to climate change (Butz and Safford 2011). To consider impacts of climate change from this project, carbon cycling was evaluated.

Alternative 1 - No Action

Direct, Indirect and Cumulative Effects

Effects on Carbon Cycling

Implementation of the no action alternative would have no direct effects on carbon cycling, since no activities would occur that would contribute to atmospheric carbon. Indirectly, the continued accumulation of untreated fuels in the project area would increase the risk that future wildfires would be widespread and of high severity (see the project Fire and Fuels Report). Carbon loss from widespread, high-severity fire would contribute to other sources of greenhouse gases at the project area and State levels. For example, the C02 emissions predicted from no action in the event of a wildfire via FOFEM modeling (see project air quality report) amounted to 26,673 pounds per acre averaged over the ten-year period.

Effects of Climate Change

Forest preservation (i.e., no active management) can avoid CO_2 emissions. Net carbon storage will cease when the forest meets its biophysical equilibrium – when carbon inputs equal carbon outputs. Absent natural disturbance, the carbon stock then essentially becomes a static pool (US Environmental Protection Agency [EPA] 2005).

Ongoing trends in the project area (e.g., continued accumulation of untreated fuels, fire suppression activities) would continue, with any change in conditions occurring due to natural processes and human-influenced trends from a global context over time, regardless of a no action decision. A landscape with unnaturally high fuel concentrations and in which suppression of fire continues would be less resilient to the predicted increases in wildfire severity as climate change progresses.

Effects Common to Alternatives 2 and 3

Direct and Indirect Effects

Effects on Carbon Cycling

Implementation of the proposed fuel treatments would result in some short-term releases of carbon, both from prescribed fire and from use of helicopters for aerial ignition, use of chainsaws for precommercial thinning and pruning, and use of dozers to construct or reconstruct approximately 4.61 miles of fire line (Alternative 2 only). Short-term emissions of carbon from the proposed prescribed fire activities would occur during 1-3 burn periods per year (each burn period would average 1-2 days) over approximately 6-10 years.

Thinning and pruning would occur intermittently over the life of the project, while dozer fireline construction/reconstruction would likely be accomplished in the first year or two of implementation. Carbon emissions from equipment use associated with those activities would be short-lived and would not recur over the life of the project.

The burning prescription would favor conditions that would promote mostly low- to moderate-severity surface fire, with limited amounts of high-severity fire (see the project fire and fuels report). Air quality design features would minimize harmful emissions during project implementation as well as reduce predicted emissions from future wildfires. Results from

FOFEM modeling showed that C02 emissions predicted from Alternatives 2 or 3 during implementation were estimated at 0.051 ppm and 0.039 ppm, respectively, averaged over a 10-year implementation period In the event of a wildfire occurring after implementation of either action alternative, the overall C02 emissions were modeled to be reduced from the 26,673 pounds per acre (no action) to 11,609 and 20,408 pounds per acre for Alternatives 2 and 3 respectively(see the project air quality report).

Effects of Climate Change

Although future climate change at the local level is uncertain, implementation of either action alternative would reduce the risk of future high-severity fires (see the project fire and fuels report), thereby improving the resiliency of the project area to drier or seasonally drier conditions. Moving the project area toward historic fire regime conditions would likely enhance the ability of project area ecosystems to adapt to climate change, whether the shift is toward drier or wetter conditions. If the local climate shifts toward wetter conditions, reduction of current fuel levels would not have a detrimental effect.

Cumulative Effects

As noted above, future fire behavior in the project area (as discussed in the project fire and fuels report) is predicted to be much lower than under the no action alternative. Short-term emissions of carbon from the proposed activities would likely be offset in the event of a future wildfire occurring in or adjacent to the project area. These carbon emissions, however, would be expected to emulate emissions from mostly low- to moderate-severity surface fire, which occurred historically in the project area.

At the global scale, either action alternative would not likely have a measureable effect on climate change. Because greenhouse gases from project activities would mix readily into the global pool of greenhouse gases, it is not possible to determine the indirect effects of greenhouse gas emissions from single or multiple sources (e.g., at the project level). In addition, because the Green-Horse project is quite small in the context of global atmospheric CO_2, implementation of either action alternative will have no measureable effect on global climate change (USDA Forest Service 2009a). Additionally, available data indicate that 33 million acres of forest in California store over 13 billion tons of carbon in live trees, snags and down wood (Christensen et al. 2007). The 58,349-acre project area represents a small portion (0.17 percent) of forest lands in California; proposed treatments constitute and even smaller portion (41,836 acres or about 0.1 percent under Alternative 2 and 13,275 acres or 0.04 percent under Alternative 3).

The benefits of fuel reduction would likely begin to decline after about 15-20 years, at which time additional prescribed fire treatments may be needed – depending on occurrence of wildfire and other natural disturbance in the project area.[54]

Comparison of effects between Alternatives 2 and 3

Direct Effects

Alternative 3 would treat considerably fewer acres than Alternative 2; the reduced acres of prescribed fire would, therefore, contribute less short-term carbon loss than Alternative 2. Conversely, the benefits of fuel reduction and enhanced landscape resilience would be realized

[54] Any future treatments beyond those proposed in this EA would be analyzed in a new NEPA document.

over a smaller area than under Alternative 2; effects associated with climate change in the untreated areas would be similar to those described under Alternative 1 (no action).

Inventoried Roadless Areas

On May 28, 2009, Secretary Thomas J. Vilsack reserved final decision authority over certain forest management and road construction projects in inventoried roadless areas (IRA). The Secretary's Memorandum 1042-154 is intended to assure careful evaluation of actions in inventoried roadless areas while long term roadless policy is developed and relevant court cases move forward.

On August 3, 2009, the Forest Service received re-delegation of authority from the Secretary to authorize:

> *a) Approval of any necessary timber cutting or removal or any road construction/reconstruction in emergency situations involving wildfire suppression, search and rescue operations, or other imminent threats to public health or safety in inventoried roadless areas. The local line officer is delegated authority to make these decisions.*
>
> *b) Approval of any timber cutting, sale, or removal in inventoried roadless areas incidental to the implementation of an existing special use authorization. Road construction/reconstruction is not authorized through this re-delegation without further project specific review. The local line officer is delegated authority to make these decisions.*

On October 16, 2009, the Secretary re-delegated authority to the Forest Service for the cutting, sale, or removal of generally small diameter timber when needed for one of the following purposes:

> *c) To improve threatened, endangered, or sensitive species habitat; or*
>
> *d) To maintain or restore the characteristics of ecosystem composition and structure, such as to reduce the risk of uncharacteristic wildfire effects within the range of variability that would be expected to occur under natural disturbance regimes of the current climatic period; or*
>
> *e) For administrative and personal use, as provided for in Title 36, Code of Federal Regulations 223, where personal use includes activities such as Christmas trees and firewood cutting and where administrative use includes providing materials for activities such as construction of trails, footbridges, and fences.*

The project area includes approximately 16,168 acres of the Devils Rock Inventoried Roadless Area (IRA). Fuel conditions in the IRA are typical of those across the project area.

Research Natural Areas

The Green-Horse project area encompasses approximately 5,378 acres of the 5,550-acre Devils Rock-Hosselkus Research Natural Area (RNA). The RNA is managed for two target elements – the limestone ecosystem (unique element) and the California black oak plant community (USDA Forest Service 2012).

Alternative 1 – No Action

Under the current fuel conditions, the project area – including the Devils Rock-Hosselkus RNA – would be at risk of adverse effects to the two target elements from widespread, high-intensity fire. In particular, the California black oak target element would be at risk of total consumption under current fuel conditions (see the Native Vegetation discussion above).

Effects Common to Alternatives 2 and 3

Both action alternatives propose to treat the entire 5,378 acres of the RNA within the project area. Treatments would consist of 5,376 prescribed broadcast or underburning and two acres of hand thinning, pruning, piling and pile burning. No road construction, road reconstruction or felling of commercial size trees within the RNA is proposed under either action alternative.

Project design features (BOT-2, WILD-4) would protect the limestone ecosystem from adverse effects during project activities (i.e. mechanized equipment and pile construction). There is little evidence that fire will significantly degrade the characteristics of the limestone ecosystem element in the RNA (USDA Forest Service 2012). The predicted low fire intensity over most of the treated areas would serve to moderate future fire behavior in these ecosystems to more closely resemble historic fire intensities (see the Wildfire and Fuels section).

As noted in the Native Vegetation discussion above, the prescribed fire, which would be mostly low-intensity surface fire, would not appreciably reduce overstory conifers that may compete with California black oak for dominance. However, the low-intensity fire would remove conifer seedlings and saplings and, where isolated patches of moderate- to high-intensity prescribed fire occur, some competing overstory conifers would be removed. Both action alternatives would trend the project area toward a more natural fire regime.

Short-Term Uses and Long-Term Productivity, Irreversible and Irretrievable Commitments of Resources

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity and any irreversible or irretrievable commitment of resources" (40 CFR 1502.16).

Alternative 1 – No Action

Under the No Action alternative, the risk of large high-severity fires would increase. High-severity fire would result in widespread loss of vegetation, and the diminished soil cover would be inadequate to limit erosion and sediment transport. Modeling predicts that, under this alternative, up to 69 percent (see table 3-4 above) of the project area would incur high-severity fire under 90th percentile fire weather conditions if initial attack does not successfully suppress the fire. Formation of gullies and sediment deposition into project area streams – and subsequently into Shasta Lake – would occur in large, severely burned areas. Given that nine percent of the project area has a high or very high erosion hazard rating (EHR) and another 24 percent has moderate to high (EHR),[55] soil loss resulting from high-severity fire would be a significant irretrievable loss.

[55] See table 3-26 on page 123

Effects Common to Alternatives 2 and 3

Proposed treatments under Alternatives 2 and 3 would likely result in a general enhancement of long-term soil productivity. Prescribed fire would add nutrients to the soil. Some accelerated soil erosion could occur resulting in a localized loss of nutrients, and some nutrients could be removed to the atmosphere during prescribed burning. The soil loss from erosion would be above baseline conditions but the proposed design features (WATER-1, WATER-2, WATER-4, WATER-6 through WATER-8; RIPN-1, RIPN-3, RIPN-5 through RIPN-7) would prevent significant irretrievable soil loss.

Alternative 2 – Proposed Action (Revised)

The proposed treatments under this alternative would be predicted to enhance long-term soil productivity through reducing the risk of future high-severity fires. Hand thinning and burning of excessive fuel accumulations would add nutrients to the soil. Isolated occurrences of accelerated soil erosion could occur, which would cause a localized, limited loss of soil nutrients; in addition, some nutrients would be volatilized to the atmosphere during prescribed burning. While soil loss under this alternative would be above baseline conditions, the proposed design features would prevent significant irretrievable soil loss.

Alternative 3 – No Forest Plan Amendment

The effects of this alternative would be the same as under Alternative 2 in the areas proposed for treatment. However, this alternative would treat only about a third of the project area. In the event of a high-severity wildfire, significant irretrievable loss of soil would be likely to occur in the majority of the project area that would remain untreated, similar to Alternative 1.

Consistency with the Forest Plan and Other Regulatory Direction

As noted in chapter 1 of this document, the desired condition for the Shasta Unit, National Recreation Area aided in developing the purpose of and need for the project. In addition, Alternatives 2 and 3 were designed to ensure compliance with the Forest Plan. The project design incorporated Forest Plan direction, including standard and guidelines that were applicable to the project. Examples of where portions of the project were developed based on Forest Plan direction include:

- Fuels treatment focuses on prescribed fire, and treatment was based on (1) public safety; (2) high investment situations; (3) known high fire occurrence areas; and (4) coordinated resource benefits (Forest Plan, 8d-e, p. 4-17).
- A treatment prescription specific to developed facilities and design feature REC-2., which requires coordination with recreation staff when treating vegetation in and adjacent to developed recreation facilities (Forest Plan, 16d, p. 4-24).
- A limited operating period within 0.25 miles of northern spotted owl nesting and roosting suitable habitat and 0.25 miles of bald eagle known nest sites (WILD-1a, WILD-2) (Forest Plan, 25i., p. 4-30).
- A treatment prescription specific to the bald eagle nesting sites to reduce the risk of damage from a wildfire (Forest Plan, 25j., p. 4-30.
- Design features AIR-1 and AIR-2 provide for coordination with applicable agencies and affected landowners and compliance with air quality laws (Forest Plan, 1, pp. 4-13 and 4-14.

- Design feature ARCH-2 requires a buffer to protect known archaeological sites (Forest Plan, 6f, p. 4-16).
- Design feature WILD-3 provides a buffer around any known cave entrance within the project area (Forest Plan, 2b., p. 4-14).
- Design features WATER-2, WATER-6 and RIPN-1 through RIPN-10 address aquatic conservation strategy objectives (Forest Plan, p. 4-53)
- RIPN-1 through RIPN-4 designate riparian reserve widths (Forest Plan, pp. 4-53 through 4-54).
- As noted in appendix B, WATER and RIPN design features address Best Management Practices (Forest Plan, 18c., p. 4-25).
- Design feature WATER-3 provides protection measures to minimize soil disturbance (Forest Plan, p. 4-62).
- Design features RIPN-, RIPN-5 and RIPN-6 provide restrictions on use of prescribed fire in riparian reserves (Forest Plan, 6d, p. 4-57).
- Design feature WILD-3 provides protection measures for bats that could use caves within the project area (Forest Plan, p. 4-62).
- Design feature SUP-1d requires temporary low cost interpretive displays or other forms of information at key locations to explain the purpose, need, and benefits of the project (Forest Plan 9, p. 4-65)

In addition, the analysis addressed standard and guidelines compliance by completing:

- A cumulative watershed effects analysis for HUC 8 (Forest Plan, 18a., p, 4-25).
- An evaluation of potential effects to Forest Service Sensitive and Forest Endemic plants (Forest Plan, 4b., p. 4-14).
- An evaluation of the scenery resource to ensure compliance with the visual quality objectives in the Forest Plan (21, pp. 4-27-28 and 13-14, p. 4-65).
- An evaluation of management indicator assemblages (Forest Plan, pp. 3-11, 3-24 through-3-26).
- An evaluation of the aquatic conservation strategy objectives for the action alternatives (see Appendix B) (Forest Plan, p. 4-53 and 6.1, p. 4-56).

As noted under “Non-Significant Forest Plan Amendment” in this chapter, based on the treatment prescriptions, dead and down material would average 5-15 tons per acre. To ensure compliance with the Forest Plan, the amendment would be needed. Based on this review, both action alternatives are in compliance with the Forest Plan with implementation of the project-level amendment.

Chapter 4. Consultation and Coordination

Preparers and Contributors

The following Interdisciplinary Team (IDT) members prepared this DEIS:

Table 4-1. List of preparers – Green-Horse project DEIS

Specialist	Organization	Title	Contribution
Christine West	VMS Enterprise	Botanist	Special status plants and fungi Invasive species Geospatial data
Cedra Hill	VMS Enterprise	GIS Specialist	Geospatial data
Breton Friel	HSG	Archaeologist	Cultural resources
Jules Riley	VMS Enterprise	Hydrologist	Hydrology Soils Geology
Anna E. “Betsy” Hammet	VMS Enterprise	Biological Scientist	ID Team leader Writer/Editor
Ben Newburn	VMS Enterprise	Fuels Specialist	Fire and fuels Air quality Recreation/Scenery/Special uses
Fran Smith	ACT2 Enterprise	Fisheries Biologist	Special status aquatic species
Trish Johnson	VMS Enterprise	Wildlife Biologist	Special status terrestrial wildlife species

Agencies, Organizations and Private Individuals

The Forest Service consulted the following Federal, State, and local agencies; Tribes; and private individuals, industry representatives and organizations during the development of this environmental analysis:

Table 4-2. List of Federal, State and local agencies contacted during the scoping period

Name	Title	Company
Buford Holt	Environmental Specialist	U.S. Bureau Of Reclamation
Matt Kelley		US Army Corps of Engineers
Robert Carey	Consulting Biologist	US Fish and Wildlife Service, Yreka Field Office
Lindsey Hellekson	Consulting Biologist	US Fish and Wildlife Service, Yreka Field Office
Rick Kyle	Shasta-Trinity Unit Chief	CalFire
Curt Babcock		California Department of Fish and Game
Phil Woodward		Central Valley Regional Water Quality Control Board

Name	Title	Company
Russ Mull	Air Pollution Control Officer	Shasta County Air Quality Management District
Chairman		Shasta County Board Of Supervisors
Mary Pfeiffer	Agricultural Commissioner	Shasta County Department of Agriculture
		Shasta County Department of Resource Management, Planning Division

Table 4-3. List Tribal representatives contacted during the scoping period

Name	Title	Company
Caleen Sisk-Franco	Tribal and Spiritual Leader	Winnemem Wintu Tribe
Mark Franco	Headman, Village of Kerekmet	Winnemem Wintu Tribe
Wade McMaster	Tribal Chairperson	Wintu Tribe of Northern California
Barbara Murphy	Tribal Chairperson	Redding Rancheria
Gloria Gomes	Tribal Leader	United Tribes of Northern California

Table 4-4. List of private individuals, private industry representatives and organizations contacted during the scoping period

Name	Title	Company
Mike Han	Manager (Jones Valley Resort, Lakeview Resort and Sugarloaf Resort)	Shasta Lake Resorts
Jane Wallukait	Manager	Silverthorn Resort
John & Anna Harkrader		Shasta Marina
Matt Doyle	Manager	Shasta Lake Caverns
Kristine Kuhn		Packers Bay Marina
Steve Barry		Holiday Harbor Resort
Robert Rollins	Manager (Bridge Bay Resort and Digger Bay Resort)	Seven Crowns, Inc.
Larry & Shannon McCraken		Antlers Resort & Marina
Martin & Nicole Howard		Antlers RV Park and Campground
David Grey		Tsasdi Resort
Harold Jones		Sugarloaf Cottages
Darrell Shaidell		Shasta Lake RV Resort and Campground
Irene Ohlendorf		Salt Creek Resort and RV Park
Ross & Charlotte Marshall		Lakeshore Inn and RV
Jim Moreland		Kamloops Camp
Robert Trujillo		Doney Creek Lakeshore Villa RV Park
Gary Penberthy	Campbell Creek Recreation Resident	

Name	Title	Company
Rodger V. Frazier	Campbell Creek Recreation Resident	
Mary Beaver	Campbell Creek Recreation Resident	
Elmer A. Fricke	Campbell Creek Recreation Resident	
Merle Haggard	Campbell Creek Recreation Resident	
John Miller, Jr.	Campbell Creek Recreation Resident	
Scott & Keri Long	Campbell Creek Recreation Resident	
Steven J. Mook	Campbell Creek Recreation Resident	
John & Linda Clayton	Campbell Creek Recreation Resident	
Craig Johnson	Campbell Creek Recreation Resident	
Dennis Lorenzetti	Campbell Creek Recreation Resident	
Phillip Gebhardt	Campbell Creek Recreation Resident	
Thomas Franklin	Campbell Creek Recreation Resident	
Jeffery Fetherolf	Campbell Creek Recreation Resident	
Virginia Tobin	Campbell Creek Recreation Resident	
Keith Stroud	Campbell Creek Recreation Resident	
Daniel Sampson	Campbell Creek Recreation Resident	
Pooh & Debbie Bear	Campbell Creek Recreation Resident	
Shirley A. Main	Campbell Creek Recreation Resident	
David & Diana Mitzel	Campbell Creek Recreation Resident	
Ray & Janet Dagle	Campbell Creek Recreation Resident	
Gary Stein	Campbell Creek Recreation Resident	
Duane Anderson	Campbell Creek Recreation Resident	
Gene Rider	Campbell Creek Recreation Resident	
John Hallgren	Campbell Creek Recreation Resident	
Richard Scheler	Campbell Creek Recreation Resident	
Blaise & Joan Smith	Campbell Creek Recreation Resident	
Henry W. Challe	Campbell Creek Recreation Resident	
Seven McLeod	Didallis Recreation Resident	
Virginia Perkins	Didallis Recreation Resident	
Randall & Judith Smith	Didallis Recreation Resident	
Kenneth L. Pope	Didallis Recreation Resident	
Franklin Henderson	Didallis Recreation Resident	
Jim Forcella	Didallis Recreation Resident	
Scott Greacen	Executive Director	EPIC – Environmental Protection Information Center
Kimberly Baker	Public Lands Advocate	EPIC – Environmental Protection Information Center
George Sexton	Conservation Director	Klamath Siskiyou Wildlands Center
Denise Boggs	Executive Director	Conservation Congress
Joseph Bower		Citizens for Better Forestry
Kimberly Baker	Forest & Wildlife Protection	Klamath Forest Alliance
Kyle Haines		Klamath Forest Alliance
Dick Artley		

Name	Title	Company
Kris Koeberer		Shasta Recreation Company
Richard Svilich	Northern California Representative	American Forest Resource Council
Kate Tiedeman		California Wilderness Coalition
		The Nature Conservancy
Kyle Haines		Sierra Club-Shasta Group
Herb Baldwin		Sierra Pacific Industries
		Californians for Alternatives to Toxics
		Jones Valley Fire Company
John Andrews		VESTRA Resources, Inc.
Randy Morrison	Regional Director	Mule Deer Foundation
Wayne Dunham	Redding Chapter Chair	California Deer Association

Abbreviations, Acronyms and Glossary

Abbreviations and Acronyms

ACS	Aquatic Conservation Strategy
ARR	Archaeological Reconnaissance Reoport
BAER	Burned Area Emergency Response
BehavePlus	Surface fire behavior spread model used to predict fire behavior in stands before and after proposed treatments
BMP	Best Management Practice
BMPEP	Best Management Practice Evaluation Program
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWD	Coarse Woody Debris
CWE	Cumulative Watershed Effects
CWPP	Community Wildfire Protection Plan
DN	Decision Notice
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ERA	Equivalent Roaded Acres; a component of the Cumulative Watershed Effects model
ERA/TOC	Equivalent Roaded Acres divided by Threshold of Concern in the Cumulative Watershed Effects model
ESA	Endangered Species Act
FlamMap	A fire behvaior mapping and analysis program used to compute potential fire behavior characteristics over a landscape.
FOFEM	First Order Fire Effects Model (a model used to predict fire effects in stands before and after the proposed treatments)
FOREST PLAN	Land and Resource Management Plan (also LRMP)
FS	Forest Service
GEO	Landslide potential (mass wasting), a component of the Cumulative Watershed Effects model
IDT	Interdisciplinary Team
LRMP	Land and Resource Management Plan (also Forest Plan)
LSR	Late Successional Reserve
MA	Management Area
MIA	Management Indicator Assemblage
MOU	Memorandum of Understanding
NCRWQCB	North Coast Regional Water Quality Control Board

NEPA	National Environmental Policy Act of 1969
NFP	National Fire Plan
NOAA	National Oceanic and Atmospheric Administration
NFMA	National Forest Management Act of 1976
NMFS	National Marine Fisheries Service
NF	National Forest
NFS	National Forest System
NOS	Normal Operating Season
NSO	Northern Spotted Owl
NWCG	National Wildfire Coordinating Group
OSHA	Occupational Safety and Health Administration
PM_{10}	Particulate Matter < 10 Microns in Size
ROD	Record of Decision
RR	Riparian Reserve
SMZ	Streamside Management Zone
SONCC	Southern Oregon / Northern California Coasts
TEPS	Threatened, Endangered, Proposed and Sensitive
USDA	United States Department of Agriculture
USLE	Universal Soil Loss Equation, a Component of the Cumulative Watershed Effects Model
USFWS	US Fish and Wildlife Service
VQO	Visual Quality Objective
WSR	Wild and Scenic River
WUI	Wildland-Urban Interface
WWOS	Wet Weather Operations Standards

Glossary

90th Percentile Weather Conditions – the highest 10 percent of fire weather days, where fuel moisture, temperature, relative humidity and wind speed values represent the upper 10 percent of the data based on historical observations.

Activity Center (NSO) – an area of concentrated activity of either a pair of northern spotted owls (NSO) or a territorial single NSO.

Aerial ignition – method of igniting a prescribed fire that entails the use of aerial equipment such as helicopters equipped with an ignition device. Aerial ignition, if conducted properly, enhances safety, mitigates hazards associated with ground ignition, and reduces the number of personnel exposed to risk.

Anadromous fish bearing streams – streams that support fish species that return from the ocean to reproduce.

Backing fire – a segment of fire perimeter oriented opposite the direction of maximum spread. The rate of spread and fireline intensity are usually low.

Burn plan (prescribed burn unit plan) – a field document, required for all prescribed burning activities, that sets forth the details for conducting a site-specific burn treatment. The prescribed burn plan details the prescription parameters and professional standards to be utilized in conducting the burn.

Burn probability modeling – a modeling method that simulates the effect of the ignition and spread of a very large number of fires on a raster landscape to calculate spatially explicit outputs (i.e. likelihood of ignition) on a landscape level; model used to calculate burn probabilities on a given landscape.

California Air Resources Board (CARB) – a department in the California Environmental Protection Agency established in 1967 in the Mulford-Carrell Act, combining the Bureau of Air Sanitation and the Motor Vehicle Pollution Control. The stated goals include attaining and maintaining healthy air quality, protecting the public from exposure to toxic air contaminants; and providing innovative approaches for complying with air pollution rules and regulations.

Communities at risk – identified communities within the WUI at high risk to wildfire, listed, published and maintained in the state of California by the California Fire Alliance. The National Fire Plan directs funding to be provided for projects designed to reduce the fire risk to communities.

Critical Habitat – defined in the Endangered Species Act as

1. the specific areas within the geographical area occupied by the species, at the time it is federally listed, on which are found those physical or biological features essential to the conservation of the species, and which may require special management considerations or protection; and
2. specific areas outside the geographical area occupied by the species at the time it is listed, when it is determined by the Secretary of the Interior that such areas are essential for the conservation of the species.

Crown fire – a fire burning in the crowns of forest vegetation; can be passive, active, independent or intermittent, as defined below (Scott and Reinhardt 2001):

- Passive crown fire is a crown fire in which individual or small groups of trees torch out, but solid flaming in the canopy cannot be maintained except for short periods. Passive crown fire encompasses a wide range of crown fire behavior from the occasional torching of an isolated tree to a nearly active crown fire. Also called torching and candling.
- Active crown fire is a crown fire in which the entire fuel complex becomes involved, but the crowning phase remains dependent on heat released from the surface fuels for continued spread. Also called running and continuous crown fire.
- Independent crown fire spreads without the aid of a supporting surface fire.
- Intermittent crown fire alternates in space and time between active crowning and surface fire or passive crowning.

Cumulative watershed effects – environmental changes that are affected by more than one land-use activity and that are influenced by processes involving the generation or transport of water. Almost all environmental changes are cumulative effects, and almost all land-use activities contribute to cumulative effects. Cumulative effects first must be evaluated to decide what actions are appropriate. The likely direct and indirect effects of the planned actions must then be assessed.

Cumulative Watershed Effects (CWE) Analysis – The CWE analysis includes three models.

1. a surface erosion sediment production model (USLE),
2. a landslide sediment production model (GEO), and
3. a disturbance model to predict increased peak stream discharge, based on equivalent roaded acres (ERA). The CWE models of sedimentation (surface erosion and landslides [USLE and GEO]) and hydrologic runoff (ERA) accumulate disturbances relative to land sensitivity at the 7th and 5th field watershed scales, based on a set of assumptions and coefficients. The estimated results fall on a continuum. As disturbances increase over

time and space, at some point the risk of initiating or contributing to existing adverse cumulative watershed impacts becomes a cause for concern.

Danger tree (hazard tree) – a standing tree that presents a hazard to employees due to conditions such as, but not limited to, deterioration or physical damage to the root system, trunk, stem or limbs, and the direction and lean of the tree (US Department of Labor OSHA 1994).

Direct fire suppression (direct attack) – any treatment applied directly to burning fuel such as wetting, smothering, or chemically quenching the fire or by physically separating the burning from unburned fuel. This includes the work of urban and wildland fire engines, fire personnel and aircraft applying water or fire retardant directly to the burning fuel. For most agencies, the objective is to construct a fireline around all fire meant to be suppressed.

Ecosystem or Watershed Analysis – a systematic procedure for characterizing watershed and ecological processes to meet specific management and social objectives.

Elevated CWE Risk Ratios – a risk ratio above 0.80. Elevated risk ratios are in the zone of concern. The Threshold of Concern (TOC) for a watershed is reached when a risk ratio is 1.0.

Detrimentally Disturbed Soils – Detrimentally disturbed soils are those that have been detrimentally displaced, compacted, puddled, or severely burned. Detrimental soil disturbance occurs when soil hydrological function and site productivity are adversely affected so that established threshold values for soil properties are exceeded and result in significant change.

Essential Fish Habitat – In 1996, Congress passed the Sustainable Fisheries Act (Public Law 104-297), which amended the habitat provisions of the Magnuson Act. The re-named Magnuson-Stevens Act (Act) calls for direct action to stop or reverse the continued loss of fish habitats.

Fire intensity – the rate of energy release (in BTUs) per unit length of flaming front. The amount of heat one would be exposed to per second while standing immediately in front of the fire. Often referred to as “fireline intensity” in modeling outputs.

Fire regime – the long-term fire pattern characteristics of an ecosystem described as a combination of seasonality, frequency, spatial complexity, intensity, duration and scale.

Fire return interval – the length of time between fires on a particular landscape.

Fire severity – the magnitude of fire effect on organisms, species and the environment. Commonly applied to a number of ecosystem components including – but not restricted to – soils, vegetation, trees, animals and watersheds.

Vegetation-based fire severity (Miller et al. 2009):

- unchanged = no fire effects
- Low = l0-25 percent mortality
- Moderate = 26 to 75 percent mortality
- High = greater than 75 percent

Flame length – is the average distance (in feet) from the base of the flame to its highest point. Flame length is the only measurement that can be taken easily in the field that is related to fireline intensity.

Hand lighting methods – means of igniting a prescribed fire that involve ground personnel using fire ignition tools (generally a drip torch filled with approved burn mix), which requires personnel to walk through the prescribed burn area to light the fire.

Ignition pattern – a predetermined method of lighting a prescribed fire that considers topography, location, geography, slope position and vegetation to achieve the desired results of the prescribed fire effects and enhance the ability to control the burn.

Indirect fire suppression (indirect attack) – preparatory suppression tactics used a distance away from the oncoming fire are considered indirect. Firelines may be built in this manner as well. Fuel reduction, indirect firelines, contingency firelines, backburning and wetting unburned fuels are examples. This method may allow for more effective planning. It may allow for more ideally placed firelines in lighter fuels using natural barriers and for safer firefighter working conditions in less smoke filled and cooler areas. However, it may also result in more burned acreage, larger and hotter fires, and the possibility of wasted time constructing unused firelines.

Inference Points (CWE Model) – points used to inform management decisions about the risk of cumulative watershed effects. Ecologically, a transition exists from lower to higher risk of adverse effects to beneficial uses – from insignificant to potentially significant. From a management perspective, inference points are intended to represent the center of the transition zone or inference range. Inference points do not represent the exact point at which CWEs will occur, but serve as an indicator of increasing susceptibility for significant adverse effects occurring within a watershed. When an inference point is reached, a closer look at the affected watershed is warranted. Refer to risk ratio.

Late-Successional Reserves (LSRs) – large blocks of habitat that are distributed across the range of the northern spotted owl and spaced closely enough to facilitate dispersal of owls. Late-Successional Reserves are managed to provide habitat for late successional and old growth dependent species.

Limited operating periods (LOPs) – periods when vegetation treatments are restrained due to issues of concern, generally wildlife nesting season for species of concern.

Longline (helicopter) – use of a fixed rope attached to a helicopter to transport cargo and supplies.

Lop and scatter – a method of disposal that involves cutting (lop) and dispersal (scatter) of fuels to designated specifications.

Management Indicator Assemblages (MIA) – groups of wildlife associated with vegetation communities or key habitat components, as identified in the Forest Plan (page 3-24). The Forest Plan directs resource managers to monitor assemblage habitat trends at the National Forest scale (Forest level). The Forest Plan permits the use of habitat components to represent the management indicator assemblages. Project level effects on management indicator assemblages are analyzed and disclosed as part of environmental analysis under the National Environmental Policy Act.

Minimum Impact Suppression Techniques (MIST) –wildland firefighting techniques that involve use of the minimum amount of force necessary to effectively achieve the fire management protection objectives consistent with land and resource management objectives. Methods used to suppress a wildfire while minimizing the long-term effects of the suppression action on the land.

MIST may include rehabilitation of constructed firelines and other evidence of suppression efforts.

Prescribed fire – a fire treatment to meet one or more specific management objectives. Prescribed fires follow site-specific documents directing their preparation, administration and implementation.

Pruning – removal of branch material from the bole of a living tree. The effect of pruning is to raise crown base height so that there are discontinuous fuels from the forest floor to the crown of the living trees.

Risk Ratios (CWE Model) – Risk ratios are calculated by dividing accelerated sedimentation and ERA values by the inference point value. A risk ratio of 1.0 is said to be "at the inference point."

Sclerophyllous – woody and/or leathery; used to describe the leaf characteristics of certain shrub species, most often as related to flammability.

Seral stage (sere) – a stage of successional development of a vegetation community. Four seral stages are commonly recognized – early seral, mid-seral, late seral and potential natural community (PNC)

Soil organic matter – includes amorphous and fine organic matter that makes up the O horizon, needles and twigs, and coarser materials such as branches and logs. The amount of organic material on top of the mineral soil should be maintained at levels to sustain soil microorganisms and provide for nutrient cycling. The size, amount, and distribution of organic matter maintained on the mineral soil on a long term basis should be consistent with the amounts that occur given the local ecological type, climate, and normal fire return interval for the area. Generally the desired condition is most related to finer sizes of organic matter, which contain the highest concentration of nutrients. It is important to note that an excess of organic matter on the mineral soil beyond the desired condition can pose a risk of adverse soil effects from fire.

Soil survey – a systematic examination, description, classification, and mapping of the soils in a given area. Soil surveys may be conducted at various scales or orders ranging from very detailed surveys of small parcels (1st order) to general surveys of very large regions (5th order). Refer to table 4-5 below.

Table 4-5. Soil survey orders and characteristics

Level of data needed	Field procedures	Minimum-size delineation (hectares)[1]	Typical components of map units[2]	Kind of map units	Appropriate scales for field mapping and publications
1st order – Very intensive (i.e., experimental plots or individual building sites.)	The soils in each delineation are identified by transecting or traversing. Soil boundaries are observed throughout their length. Remotely	1 or less	Phases of soil series, miscellaneous areas.	Mostly consociations, some complexes, miscellaneous areas.	1:15,840 or larger

Level of data needed	Field procedures	Minimum-size delineation (hectares)[1]	Typical components of map units[2]	Kind of map units	Appropriate scales for field mapping and publications
	sensed data are used as an aid in boundary delineation.				
2nd order – Intensive (e.g. general agriculture, urban planning.)	The soils in each delineation are identifies by field observations and by remotely sensed data. Boundaries are verified at closely spaced intervals.	0.6 to 4	Phases of soil series, miscellaneous areas, few named at a level above the series.	Consociations, complexes; few associations and undifferentiated groups.	1:12,000 to 1:31,680
3rd order – Extensive (i.e., range or community planning.)	Soil boundaries plotted by observation and interpretation of remotely sensed data. Soil boundaries are verified by traversing representative areas and by some transects.	1.6 to 16	Phases of soil series or taxa above the series; or miscellaneous areas.	Mostly associations or complexes, some consociations and undifferentiated groups.	1:20,000 to 1:63,360
4th order – Extensive (e.g., general soil information for broad statements concerning land-use potential and general land management.)	Soil boundaries plotted by interpretation of remotely sensed data. Boundaries are verified by traversing representative areas and by some transects.	16 to 252	Phases of soil series or taxa above the series or miscellaneous areas.	Mostly associations; some complexes, consociations and undifferentiated groups.	1:63,360 to 1:250,000
5th order – Very extensive (e.g., regional planning, selections of areas for more intensive study.)	The soil patterns and composition of map units are determined by mapping representative ideas and like areas by interpretation of remotely sensed data. Soils verified by occasional onsite	252 to 4,000	Phases of levels above the series, miscellaneous areas.	Associations; some consociations and undifferentiated groups.	1:250,000 to 1:1,000,000 or smaller

Level of data needed	Field procedures	Minimum-size delineation (hectares)[1]	Typical components of map units[2]	Kind of map units	Appropriate scales for field mapping and publications
	investigation or by traversing.				

1. This is about the smallest delineation allowable for readable soil maps (see Table 2-2). In practice, the minimum-size delineations are generally larger than the minimum-size shown.

2. Where applicable, all kinds of map units (consociations, complex, and associations, undifferentiated) can be used in any order of soil survey.

Suitable Habitat – habitat containing the biological and physical components necessary to meet some or all the life needs of a species.

Watershed – the entire land area that drains to a specific point. Watersheds are usually delineated by Hydrologic Unit Codes (HUC). For example:

- A 5th field watershed (5th field HUC) ranges from about 40,000 to 250, 000 acres in size.
- A 6th field watershed (6th field HUC) ranges from about 10,000 to 40,000 acres in size.
- A 7th field watershed (7th field HUC) ranges from about 2,500 to 10,000 acres in size.

See http://pubs.usgs.gov/wsp/wsp2294/ for more information.

Wet Weather Operations Standards (WWOS) – standards and guidelines developed by the Klamath National Forest in conjunction with Region 5 and a representative from the North Coast Regional Water Quality Control Board. The standards provide more specific information to assist field employees in determining when activities are at risk of not meeting Best Management Practices (BMPs). The guidelines are used to determine if conditions are favorable for wet weather or winter operations, and to provide guidance as to when conditions warrant suspension of operations, when operations may begin or resume, or when and what remedies may be appropriate, in order to protect the transportation system, maintain water quality, and preserve soil productivity.

Wildland urban interface (WUI) – the area where human development and structures (urban) intermingle with undeveloped areas (wildland)

Appendix A – Past, Current, Ongoing and Reasonably Foreseeable Actions

Table A-1 below lists and describes past, current, ongoing and reasonably foreseeable actions and events that were considered in cumulative effects analyses as appropriate for each resource affected by the Green-Horse project. Past actions and events are considered as part of the baseline for existing conditions; current, ongoing and reasonably foreseeable actions are considered in combination with implementation of any of the alternatives.

Table A-1. Past, current, ongoing and reasonably foreseeable future actions and events – Green-Horse Habitat Restoration and Maintenance Project

Activity	Description	*Date(s)	Location (HUC5 Watershed)	Scope
Bully Hill Mine operation	Vegetation removal, ground disturbance, toxic mine waste	1890s -1950s	Squaw Creek	Approximately 300-700 acres
Miscellaneous fires 1922-1991 (any size) 1992-present (less than 100 acres)	Wildfires	1922-present	In and adjacent to the project area	49,389 acres within analysis area
Bear Mountain Fire Salvage Timber Sale	Site prep (burning, mechanical); tree release and weed, salvage thin, tree planting	1991	Pit Arm Shasta Lake	45 acres total (18 acres within analysis area)
Fountain Fire	Wildfires	1992	Pit Arm Shasta Lake, Burney Creek, Little Cow Creek, Lake Britton, Pit-Roaring Creek	60,289 acres total (604 acres within analysis area)
Jones Fire	Wildfire	1999	Pit Arm Shasta Lake, Little Cow Creek, and Sacramento River/Stillwater	26,202 acres total (2,074 acres within analysis area)
Green Mountain Vegetation Management Project	Prescribed fire	2001	Squaw Creek and Pit Arm	6,600 acre project area (approximately 6,100 acres complete to date)
Gillman Shaded Fuelbreak	Thin and Chip; (Thin, Pile, and Pile Burn; Pesticide application)	2003	McCloud Arm	Approximately 132 acres
Northwoods Vegetation Management	Thin, Pile, Pile burn, Underburn	2003	Pit Arm and Sacramento Arm	1,293 project area (363 acres complete to date)
Bear Fire	Wildfire	2004	Pit Arm Shasta Lake, Little Cow Creek	10,441acres total (4,583acres within analysis area)
Bear Fuels Fire Recovery Project (Bear Helicopter Salvage portion)	Helicopter Salvage	2005 - 2009	Pit Arm Shasta Lake	Approximately 336 acres
Clikapudi Trail Loop Addition Project	Trail Addition	2006	Pit Arm Shasta Lake	Approximately 1 mile
SHU Lightning Complex Fires	Wildfire	2008	Pit Arm Shasta Lake, Little Cow Creek, and Pit-Roaring Creek	41,363 total (1,787 acres within project area)

Activity	Description	*Date(s)	Location (HUC5 Watershed)	Scope
Stein Fire	Wildfire	2008	Pit Arm Shasta Lake	1,186 acres total
Bear Hazardous Fuels Reduction Project	Thinning, piling, pile burning, replanting	2009	Pit Arm Shasta Lake	4,465 project area (350-400 acres complete to date)
Timber Harvest (Private Lands)	Timber Harvest Activities	Ongoing	Within and outside of project area	9,291 acres completed; 4962 acres approved, pending, or unlogged.
Bagley Fire	Wildfire	2012	Squaw Creek outside project area	46,011 acres
Bureau of Reclamation - Shasta Dam and Reservoir	Raising of Shasta Dam	Proposed	Shasta Dam located over 7 miles south of project area. Inundation will occur within project area.	2,498 acres of potential inundation (1,769 acres within project area)
I-5 Corridor Fuels Reduction Project	Fuels Reduction (Hand Thin, Prune, Pile, Pile Burn, Mastication, Rx Fire)	Proposed	Sacramento Arm, McCloud Arm, and Pit Arm Shasta Lake	20,025 treatment acres
Packers Bay Invasive Species Removal	Removal of non-native Scotch, French & Spanish brooms using an integrated approach on NFS lands. A combination of treatments, including herbicide, manual cutting, hand pulling & prescribed fire will be used.	Proposed	Pit Arm Shasta Lake and Sacramento Arm	112 acres

Appendix B – Best Management Practices and Aquatic Conservation Strategy

Best Management Practices

The following list of BMPs would be implemented as part of either action alternative. A description of the objective of each BMP is included, as well as how each practice would be specifically implemented. Although some of these BMPs are identified as specific to timber sale contracts, they were designed for any relevant management activity. For, additional information on the BMPs and their objectives, see the Region 5 Water Quality Management handbook (USDA Forest Service 2011b).

See the implementation checklist for BMPs in tables B-1 and B-2 on the following pages.

Table B-1. Implementation Checklist. USDA Forest Service Pacific Southwest Region. March 14, 2011

National Forest: Shasta Trinity National Forest				**Ranger District: National Recreation Area Management Unit**	
Project name:	Green-Horse Habitat Restoration and Maintenance Project			**Watershed(s):**	Pit Arm Shasta Lake Squaw Creek McCloud Arm Shasta Lake
Project type:	Fuels reduction (prescribed fire) Dozer line construction Hand thinning and pruning of small trees and brush Hand piling of thinned and pruned materials			**6th field HUC(s):**	Lower McCloud Arm Shasta Lake Lower Pit River Potem Creek – Pit River Upper Squaw Creek Middle Squaw Creek Lower Squaw Creek
Start date:				**End Date:**	
Evaluation By:				**Title:**	
Legal Description	T	R	Sections	**Date:**	
Project Line Officer				**Project Officer Signature**	

Table B-2. Implementation Checklist. USDA Forest Service Pacific Southwest Region. March 14, 2011

BMP Description	Design Measure	Completed	Citation of Environmental or Project Record Document with Page Number(s)	BMP Description
BMP 1.6 - Protecting Unstable Lands	SMZs are identified on the project map.	☐	☐	
BMP 1.8 - Streamside Management Zone Designation	Riparian Reserves widths identified, managed, and protected via design features (DF-Water 8, 9, 10, 11, 13, 15).	☐	☐	
BMP 1.19 - Streamcourse and Aquatic Protection	Treatments within known geologically sensitive areas would be field-reviewed and the treatment prescription refined as needed by an earth scientist and fuels officer (DF-Water 7, DF-Geology 1).	☐	☐	
BMP 2.11 – Servicing and Refueling of Equipment	Oil absorbing mats are used under equipment being serviced to prevent petroleum-based products from contaminating soil and water resources when fueling required.	☐	☐	
BMP 5.5 - Disposal of Organic Debris	Slash material from hardwoods (i.e., manzanita and oak branches) that are thinned within the Shasta Lake Riparian Reserve would be retained, as needed, for fish habitat improvement structures (i.e., juvenile fish cover) in the lake.	☐	☐	
BMP 5.6 – Soil Moisture Limitations for Mechanical Equipment Operations	Ground-based equipment operation is permitted only when soil moisture is low enough to avoid adverse soil and watershed effects (DF-Water 1).	☐	☐	
BMP 6.1 - Fire and Fuels Management Activities	Primary object of Green-Horse Restoration and Maintenance Project.	☐	☐	

BMP 6.2 - Consideration of Water Quality in Formulating Fire Prescriptions	Burn Plan is designed to maintain adequate soil cover while burn objectives are obtained (DF-Water 2, 3).	☐	☐	
	Ignition and pile burning limited in Riparian Reserves (DF-Water 9, 13)	☐	☐	
	The Forest Wet Weather Operating Standards are used to control access outside of the normal operating season (DF-Water 6).	☐	☐	
BMP 6.3 - Protection of Water Quality from Prescribed Burning Effects	Erosion control techniques such as water barring, or debris placement would be used on prescribed firelines (DF-Water 4).	☐	☐	
BMP 7.8 - Cumulative Off-site Watershed Effects	Cumulative watershed effects analysis evaluates likely impacts.	☐	☐	
Other Site Specific/Project Specific Water Quality Measures		☐	☐	
Other Site Specific/Project Specific Water Quality Measures		☐	☐	
Other Site Specific/Project Specific Water Quality Measures		☐	☐	

Comments or Additional Notes:

BMP 1.6 - Protecting Unstable Lands

Objective: To provide special treatment of unstable areas to avoid triggering mass slope failure with resultant erosion and sedimentation.

Explanation: This practice is an administrative and preventative control. Where unstable lands are delineated, they are taken out of suitable forest lands and are reclassified as unsuitable forest land. Using existing harvest technologies, unsuitable forest lands cannot be managed for timber production where irreversible adverse effects to soils, productivity, or watershed conditions may occur. Timber harvesting is deferred pending technology development proven to be operational on these sites without causing adverse environmental effects.

Implementation: The interdisciplinary team will prepare plans and environmental documents, utilizing information provided by specialists trained and qualified to identify unstable areas. When warranted, based on location and size of the sale, proposed harvest units may be assessed for relationships to unstable areas through aerial photo reconnaissance (most recent photos at least 1:24,000 or larger scale) and a landslide hazard map, where available. These features are then assessed on the ground as the team deems necessary. Where unstable lands are presently classified as suitable forest lands, the classification is changed to unsuitable forest lands. Unsuitable forest lands will not be harvested until they can be harvested without irreversible or unmitigable resource effects. If the team determines that current or prospective logging methods would result in irreversible or unmitigable watershed effects, then the line officer should reclassify the area to unsuitable forest land and defer harvesting.

BMP 1.8 - Streamside Management Zone Designation

Objective: To designate a zone along riparian areas, streams, and wetlands that will minimize potential for adverse effects from adjacent management activities. Management activities within these zones are designed to improve riparian values.

Explanation: As a preventive measure, roads, skid trails, landings, and other timber-harvesting facilities will be kept at a prescribed distance from designated stream courses.

Factors such as stream class, channel aspect, channel stability, sideslope steepness, and slope stability are considered in determining the limitations on activities within the width of streamside management zones (SMZ). Aquatic and riparian habitat, beneficial riparian zone functions, their condition and their estimated response to the proposed timber sale are also evaluated in determining the need for and width of the streamside management zones.

The SMZ will be a zone of total exclusion of activity, or a zone of closely managed activity as described in the “Glossary of Terms.” It is a zone that acts as an effective filter and absorptive zone for sediment; maintains shade; protects aquatic and terrestrial riparian habitats; protects channel and streambanks; and promotes floodplain stability.

Implementation: Identify the streamside management zone requirements during the environmental documentation process. Each forest's LRMP identifies specific measures to protect these zones. As a minimum, forest requirements must be identified and implemented. The timber sale project is designed to include site-specific prescriptions for preventing sedimentation and other stream damage from logging debris. The timber sale contract will be designed to ensure retention of streamside vegetation and improve the condition and beneficial functions of the riparian area.

As appropriate, water-quality monitoring is identified in the environmental document. The Timber Sale Preparation Forester is responsible for including the zones in the timber sale contract and on the sale area map as identified by the environmental document. The sale administrator is responsible for contract compliance during harvest operations.

BMP 1.19 - Streamcourse and Aquatic Protection

Objectives:

To conduct management actions within these areas in a manner that maintains or improves riparian and aquatic values.

1. To provide unobstructed passage of stormflows.
2. To control sediment and other pollutants entering streamcourses.
3. To restore the natural course of any stream as soon as practicable, where diversion of the stream has resulted from timber management activities.

Explanation: This management practice uses administrative, preventive, and corrective measures to meet the objectives.

Streams within proposed timber sale areas are surveyed and protection zones are prescribed during the timber sale planning process. The interdisciplinary team formulates stream-protection requirements, and includes the prescription in the decision document. The requirements are then included in the timber sale contract and identified on the sale area map.

The following principles are fundamental to protecting streamcourses:

4. The sale administrator must agree to location and method of streamcourse crossings prior to construction. This is done at the same time as agreements are made with the purchaser or purchaser's representative for the locations of landings, skid trails, tractor roads, and temporary roads.
5. All damage to a streamcourse, including damage to banks and channels, will be repaired to the extent practicable.
6. All sale-generated debris is removed from streamcourses, unless otherwise agreed to by the sale administrator, and in an agreed-upon manner that will cause the least disturbance.
7. Limit, or exclude equipment use in designated SMZs. Widths of SMZ and restrictions pertaining to equipment use are defined by onsite project investigation and are included in the timber sale contract. The Forest Service identifies these areas on the sale area map prior to advertising. Boundaries of zones will be modified by agreement between the contractor and sale administrator, to compensate for unforeseen operation conditions.
8. Methods for protecting water quality while utilizing tractor skid trail design in streamcourse areas where harvest is approved include: 1) end lining, 2) felling to the lead, and 3) utilizing specialized equipment with low ground pressure such as a feller buncher harvester. Permit equipment to enter streamside areas only at locations agreed to by the sale administrator and the purchaser.
9. Water bars and other erosion-control structures will be located so as to disperse concentrated flows and filter out suspended sediments prior to entry into streamcourse.
10. Material from temporary road and skid trail streamcourse crossings is removed and streambanks restored to the extent practicable.
11. In cable log yarding operations, logs will be fully airborne within the SMZ, when required by the timber sale contract.

12. Special slash-treatment site-preparation activities will be prescribed in sensitive areas to facilitate slash disposal without use of mechanized equipment.

Implementation: The sale administrator works with the purchaser's representative to ensure that the timber sale contract clauses covering the above items are carried out on the ground. Specialists can be called upon to help the sale administrator with decisions. In the event the purchaser causes debris to enter streamcourses in amounts which may adversely affect the natural flow of the stream, water quality, or fishery resource, the purchaser will remove such debris as soon as practicable, but not to exceed 48 hours, and in an agreed-upon manner that will cause the least disturbance to streamcourses.

BMP 5.5 - Disposal of Organic Debris

Objective: To prevent gully and surface erosion with associated reduction in sediment production and turbidity during and after treatment.

Explanation: This is a preventive practice to reduce excessive volumes and velocities of overland flow, promote infiltration, and prevent wildfires from consuming excessive amounts of surface and soil organic matter and creating hydrophobic soil conditions.

The interdisciplinary team will identify project controls and mitigation measures after evaluating such onsite factors as soil water-holding capacity, EHR, slope and topographic limitations, the quantity of debris: density and ratio of rearranged debris, residual ground cover density objectives, climatic variables, and the probability of creating water-repellant soils.

Implementation: The District Ranger will be responsible for debris treatment following timber sales and other projects such as chaparral manipulation.

Project planners will be responsible for determining the method(s) of debris disposal and/or placement of debris after treatment. Methods of disposal include, but are not limited to: prescribed burning, chipping and mulching, lop and scatter, and mechanical harvesting and collection.

The contracting officer’s representative will be responsible for enforcing the contract clauses that provide for debris disposal in contracted projects.

The project leader will implement the water-quality protection measures either through the contract provisions, or by use of force account crews.

BMP 5.6 - Soil Moisture Limitations for Mechanical Equipment Operations

Objective: To prevent compaction, rutting, and gullying, with resultant sediment production and turbidity.

Explanation: This is a preventive practice that reduces surface disturbance during wet soil conditions, which would result in compaction, rutting, and gullying. Soil moisture guidelines will be developed for each site, based on the characteristics of the soil.

The project should then be conducted as guided by soil erodibility, climate factors, soil and water relationships, and mass stability hazards identified by trained and qualified earth scientists (see also BMP 1.5).

Implementation: Soil conditions will be evaluated during the environmental documentation process and the interdisciplinary team will develop operating limitations as the alternatives are

formulated. Project planners will also be responsible for including appropriate contract provisions and management requirements in project work plans and environmental documentation.

For force account projects, the project leader will be responsible for determining when the soil surface is unstable and susceptible to damage, and for terminating operations.

The contracting officer's representative will determine when optimum soil conditions exist, and administer the operation to prevent adverse soil effects, in addition to suspending, or terminating operations for contracted projects as soil moisture conditions warrant.

BMP 6.1 - Fire and Fuels Management Activities

Objective: To reduce public and private losses and environmental impacts which result from wildfires and/or subsequent flooding and erosion by reducing or managing the frequency, intensity, and extent of wildfire.

Explanation: These administrative, corrective, and preventive measures include the use of prescribed fire or mechanical methods to achieve:

13. Defensive fuel profile zones,
14. Type conversions,
15. Greenbelt establishment to separate urban areas from wildlands,
16. Fuel reduction units,
17. Access roads and trails for rapid ingress and egress,
18. Fire-suppression activities,
19. Fuel utilization and modification programs, and
20. Public information and education programs.

Implementation: Fuel management will be implemented through normal program planning and budgeting and NEPA processes, predominantly, but not exclusively, by personnel in the Forest Service fire management organization.

Other resource managers, such as timber, range; watershed, and wildlife may initiate fuel-modification projects that also benefit fire management. Fuel-management projects will be evaluated by the interdisciplinary team. Management requirements, mitigation measures, and multiple resource-protection prescriptions are documented in the project-specific decision and implementation documents.

The project planners and supervisor are responsible for applying mitigation measures and prescriptions.

BMP 6.2 - Consideration of Water Quality in Formulating Fire Prescriptions

Objective: To provide for water-quality protection while achieving the management objectives through the use of prescribed fire.

Explanation: Prescription elements will include, but not be limited to, such factors as fire weather, slope, aspect, soil moisture, and fuel moisture. These elements influence the fire intensity and thus have a direct effect on whether a desired ground cover remains after burning, and whether a water-repellent layer is formed. The prescription will include at the watershed- and subwatershed-scale the optimum and maximum burn block size, aggregate burned area,

acceptable disturbance for contiguous and aggregate length for the riparian/SMZ; and expected fire return intervals and maximum expected area covered by water-repellant soils.

Implementation: Field investigations will be conducted as required to identify site-specific conditions, which may affect the prescription. Both the optimum and allowable limits for the burn to ensure water-quality protection will be established prior to preparation of the burn plan. An interdisciplinary team will assess the prescription elements and the optimum and maximum acceptable disturbance, and the fire management officer or fuel management specialist will prepare the fire prescription. The fire prescription will be reviewed by the interdisciplinary team and approved by the appropriate line officer.

BMP 6.3 - Protection of Water Quality from Prescribed Burning Effects

Objective: To maintain soil productivity; minimize erosion; and minimize ash, sediment, nutrients, and debris from entering water bodies.

Explanation: Some of the techniques used to prevent water-quality degradation are:

21. Constructing water bars in fire lines,
22. Reducing fuel loading in drainage channels,
23. Maintaining the integrity of the SMZ within the limits of the burn plan,
24. Planning prescribed fires for burn intensities so that when water-repellant soils are formed, they are within the limits and at locations described in the burn plan, and
25. Retaining or re-establishing ground cover as needed to keep erosion of the burned site within the limits of the burn plan.

Implementation: Forest Service and other crews will be used to prepare the units for burning. This will include, but not be limited to, water barring firelines, reducing fuel concentrations, and moving fuel to designated disposal and burning areas.

The interdisciplinary team will identify the SMZ and soils with high risk of becoming water-repellant as part of project planning.

BMP 7.8 - Cumulative Off-Site Watershed Effects

Objective: To protect the identified beneficial uses of water from the combined effects of multiple management activities which individually may not create unacceptable effects, but collectively may result in degraded water-quality conditions.

Explanation: Cumulative off-site watershed effects (CWE) include all effects on beneficial uses that occur away from the sites of actual land use activities and which are transmitted through the drainage system. Effects can be either beneficial or adverse and result from the synergistic or additive effects of multiple management activities within a watershed.

Professional judgment is used to evaluate CWE susceptibility, on a watershed basis, as part of the decision-making process. These assessments are made using known information about beneficial uses, climate, watershed characteristics, land use history, and present and reasonably foreseeable future land use activities. Initial evaluation of CWE susceptibility is based on what is known about the study watershed and other watersheds with similar physical and climatic characteristics. Comparison of land-disturbance history and resulting impacts to beneficial uses in these watersheds results in an estimate of the upper limit of watershed tolerance to land disturbance.

Implementation: CWE susceptibility evaluations and development of mitigative measures are accomplished through the environmental documentation process, using an interdisciplinary approach, guided by the Regional methodology. Forests having similar climatic, watershed, and land-use characteristics will work together to refine CWE assessments to be responsive to local conditions. Each forest will monitor to determine the effectiveness of CWE analysis in reducing the risk of adverse effects and obtaining desired results from mitigation measures and management requirements. Monitoring results will also be used to refine the analysis and, where necessary, modify the analysis process.

Aquatic Conservation Strategy (ACS) Objectives

This project is designed to meet the goals and objectives set forth in the Aquatic Conservation Strategy of the Northwest Forest Plan.[56] The Aquatic Conservation Strategy is to "maintain and restore the ecological health of watersheds and aquatic ecosystems contained within them on public lands" and to "prevent further degradation and restore habitat over broad landscapes as opposed to individual projects or small watersheds."

[56] USDA Forest Service and USDI Bureau of Land Management 1994

Table B-3. Aquatic Conservation Strategy Achievement

Elements	Objective	How objective is achieved
Watershed and landscape feature diversity, distribution and complexity	Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	***Fuel treatments, primarily prescribed burning, are designed to trend the project area to a natural fire condition class and to reduce the risk of uncharacteristic widespread high-intensity fire and its adverse effects to water quality, aquatic habitat and soil productivity.***
Watershed connectivity	Maintain and restore spatial and temporal connectivity within and between watersheds.	***This project, in concert with other proposed projects, would help maintain watershed connectivity over the long-term. Changes in the short-term are not anticipated.***
Aquatic system physical integrity	Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	***Fuel treatments are designed to promote low-intensity fire to back down iton Riparian Reserves to achieve needed fuels reduction while maintaining the integrity of riparian vegetation and desirable aquatic system characteristics such as stream shade and bank stability.***
Water Quality	Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems.	***The objective of this project is to protect water quality by reducing the risk of high-intensity wildfire that would likely degrade water quality.***
Sediment Regime	Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements include timing, volume, rate and character of sediment input, storage, and transport	***The objective of this project is to trend the project area toward vegetation conditions consistent with the historical fire regime. This in turn would help to maintain sediment regimes in more natural conditions.***
In stream flows	Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing.	***Not applicable to this project.***
Floodplains and water tables	Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	***Not applicable to this project.***
Species composition and structural diversity.	Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands. Provide summer and winter thermal regulation, nutrient filtering, limit surface erosion, bank erosion, and channel migration, and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.	***The project objectives are to treat Riparian Reserves fuels to maintain a dynamic equilibrium. Design features mitigate impacts to shade, soil productivity, and stability while reducing the risk of loss from high-intensity fire.***

Elements	Objective	How objective is achieved
Maintain & restore native species habitats	Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	***The project is designed to help maintain aquatic habitat by allowing fire to play a more natural role on the landscape.***

Appendix C – Various Fire-Related Maps

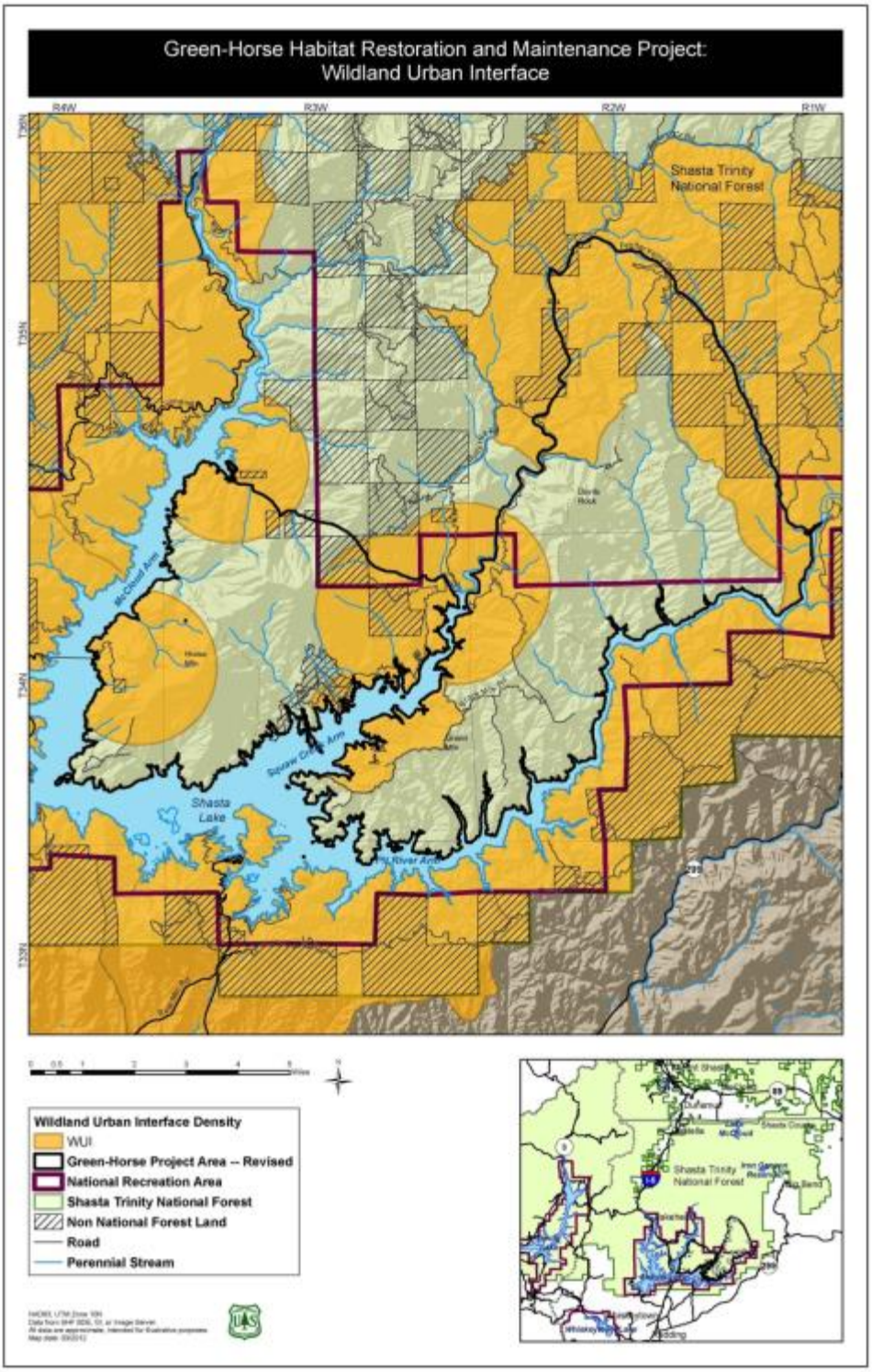

Figure C-1. Wildland-Urban interface within the Green-Horse project area

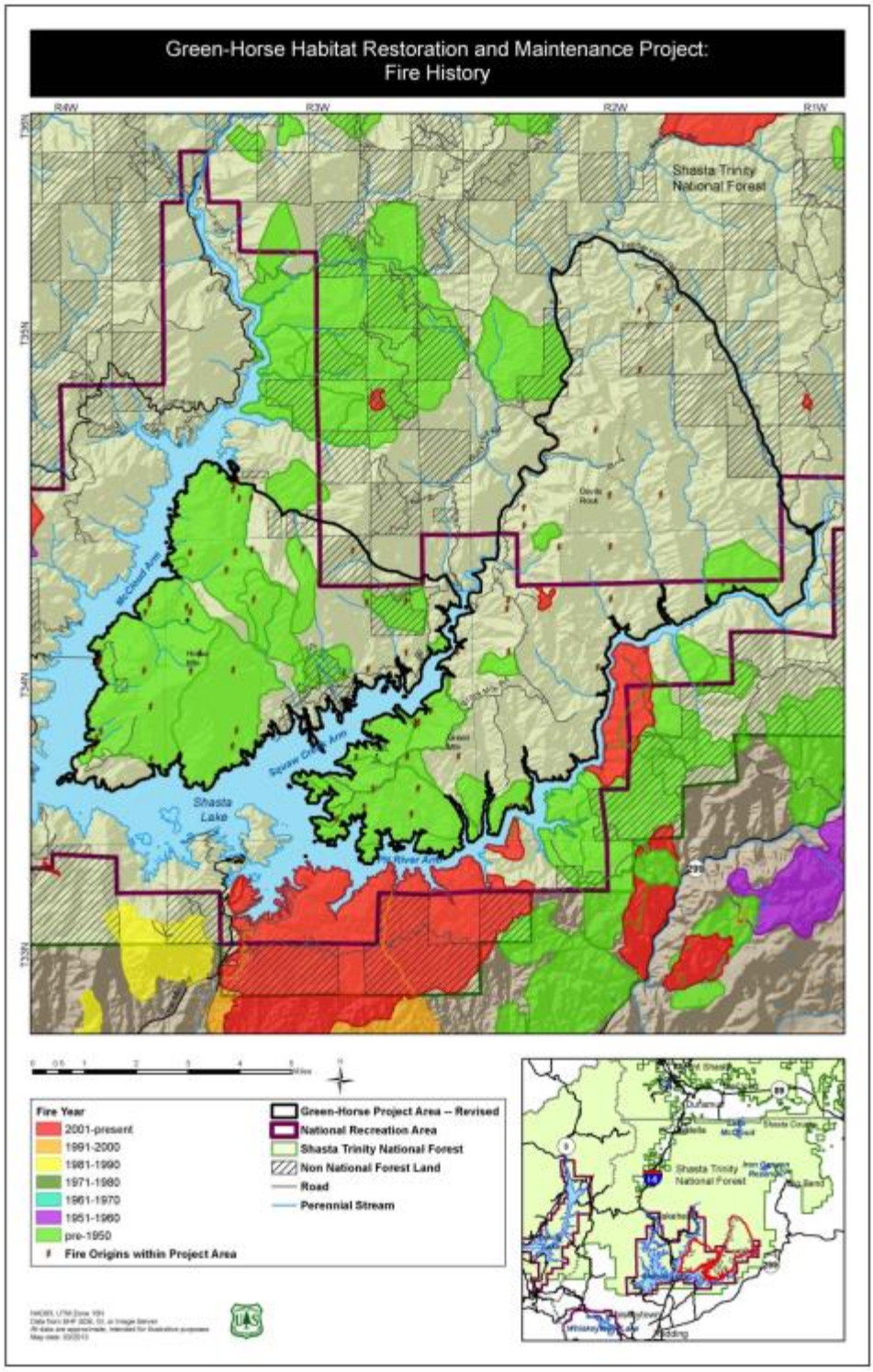

Figure C-2. Fire History in and adjacent to the Green-Horse project area

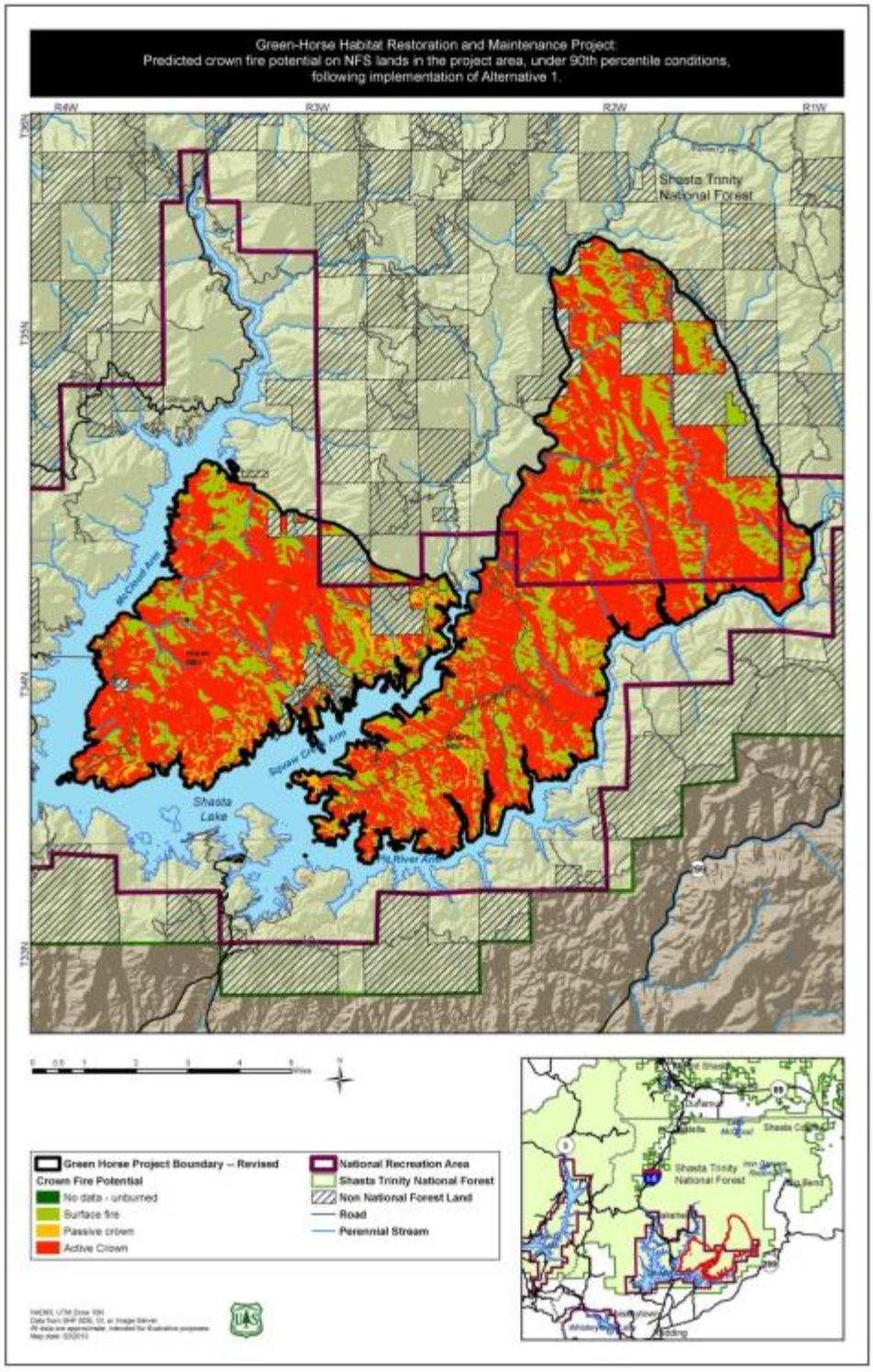

Figure C-3. Current conditions and predicted crown fire potential during a future wildfire after no action

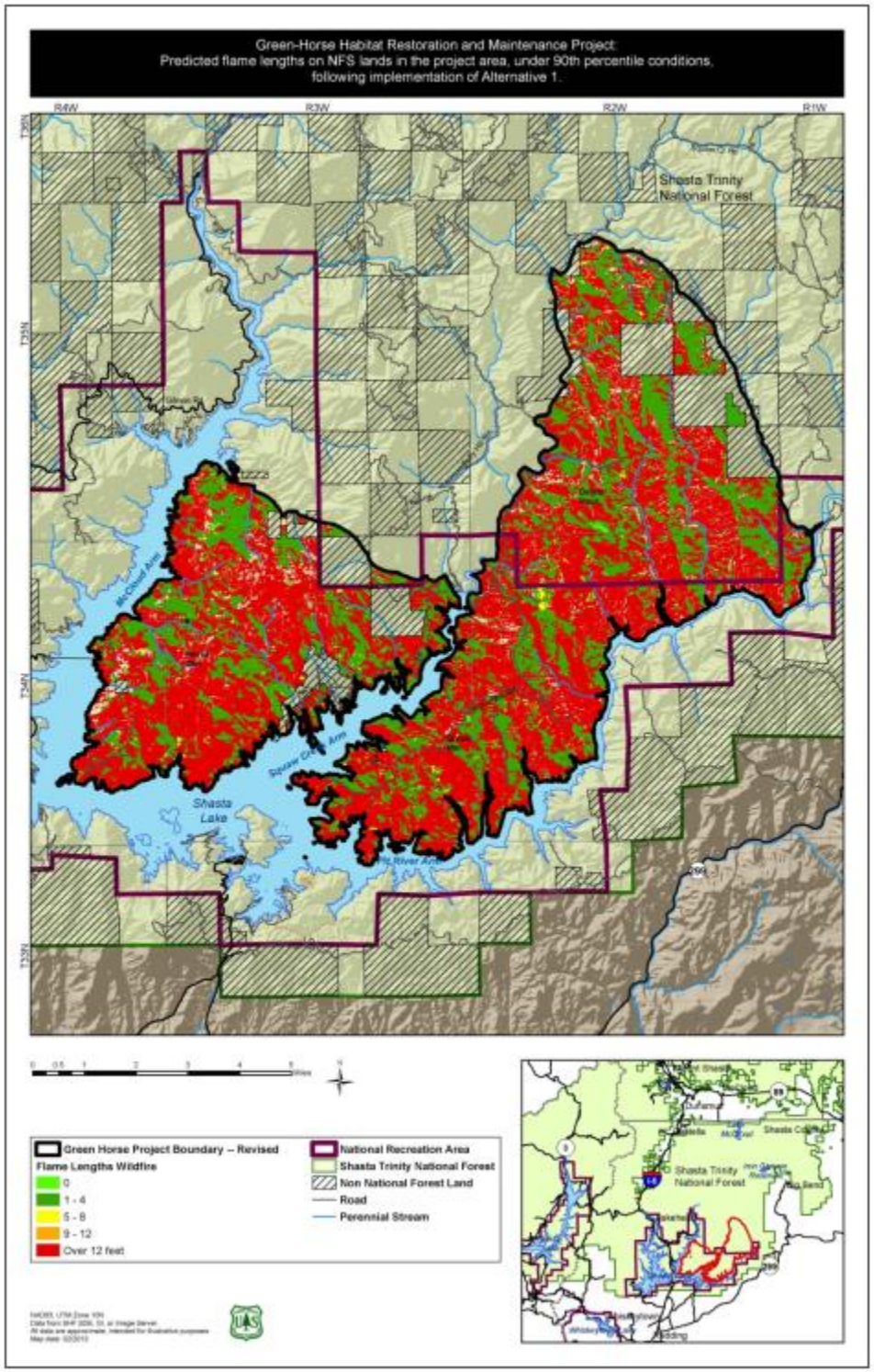

Figure C-4. Current conditions and predicted flame lengths during a future wildfire after no action

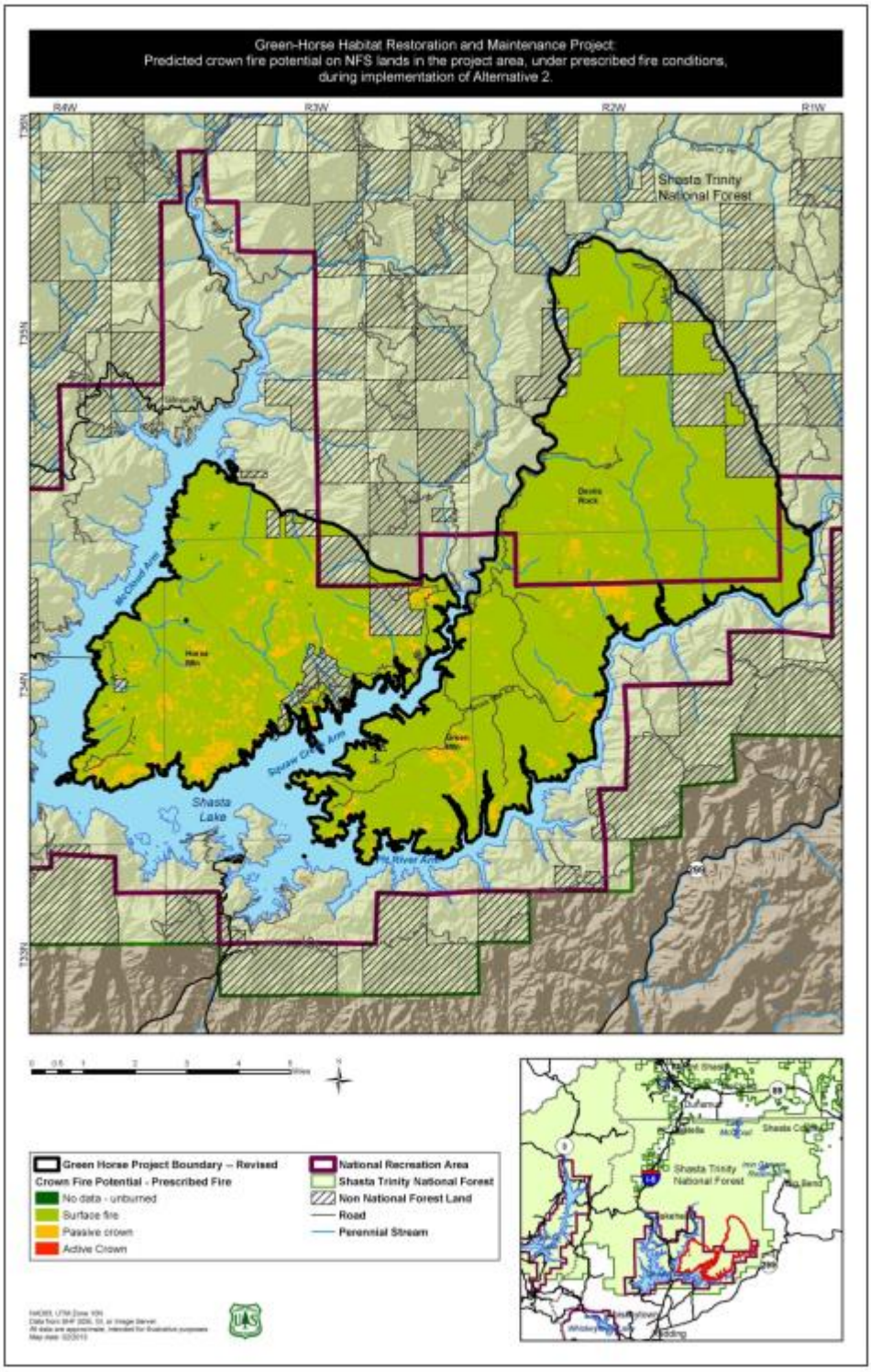

Figure C-5: Predicted crown fire potential during prescribed fire treatments – Alternative 2

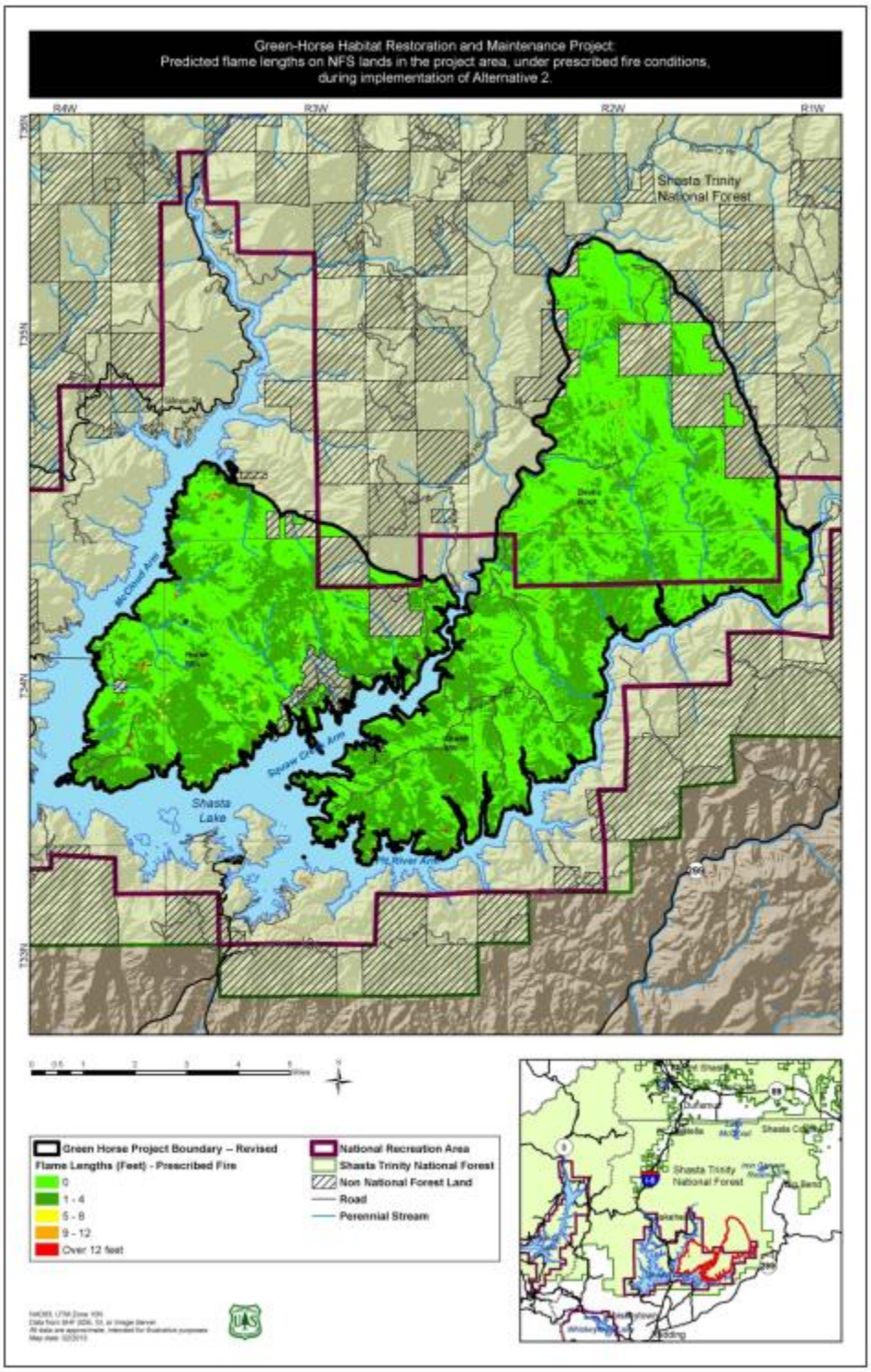

Figure C-6. Predicted flame lengths during prescribed fire treatments – Alternative 2

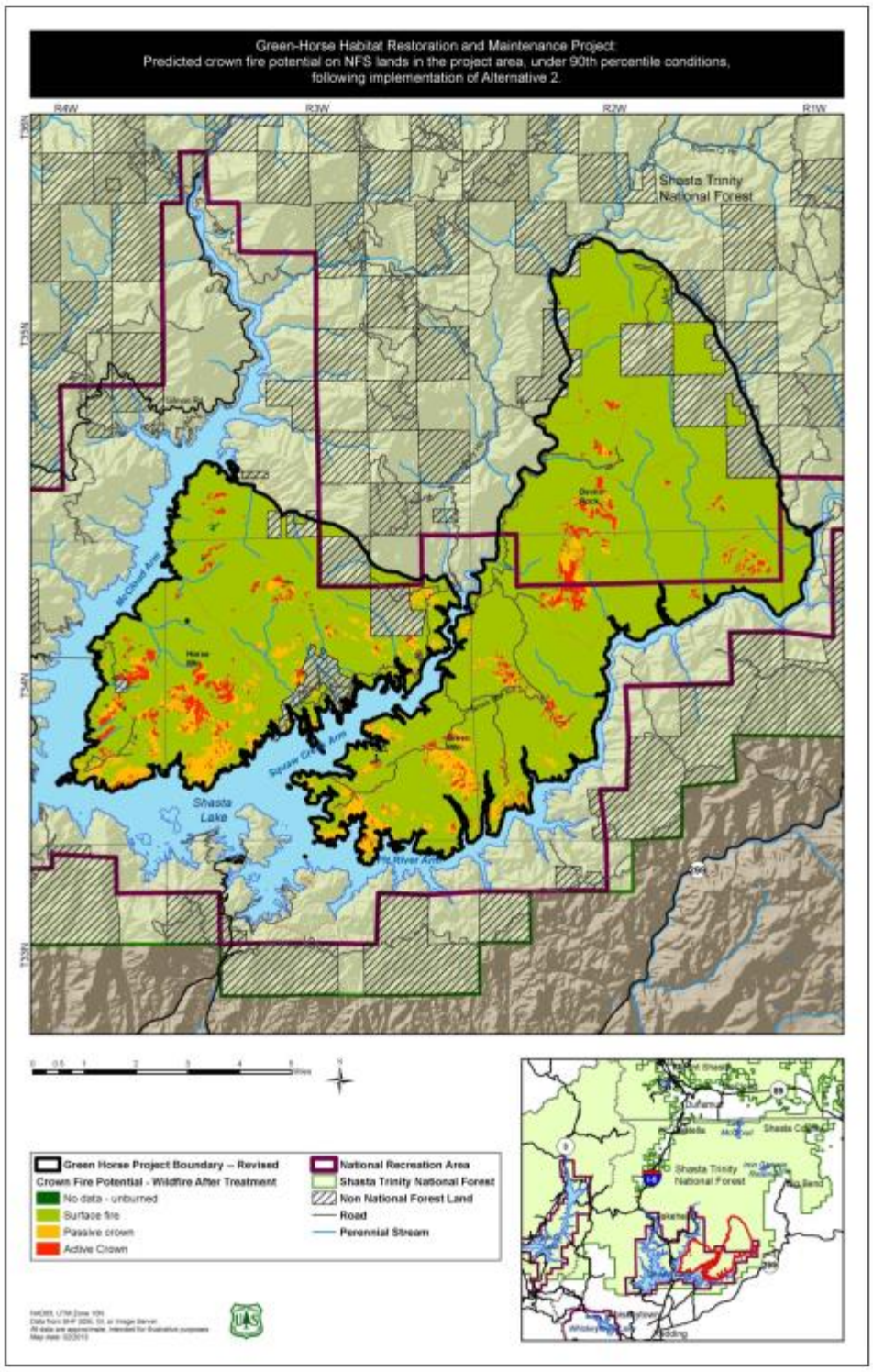

Figure C-7. Predicted crown fire potential during a future wildfire after implementation of Alternative 2

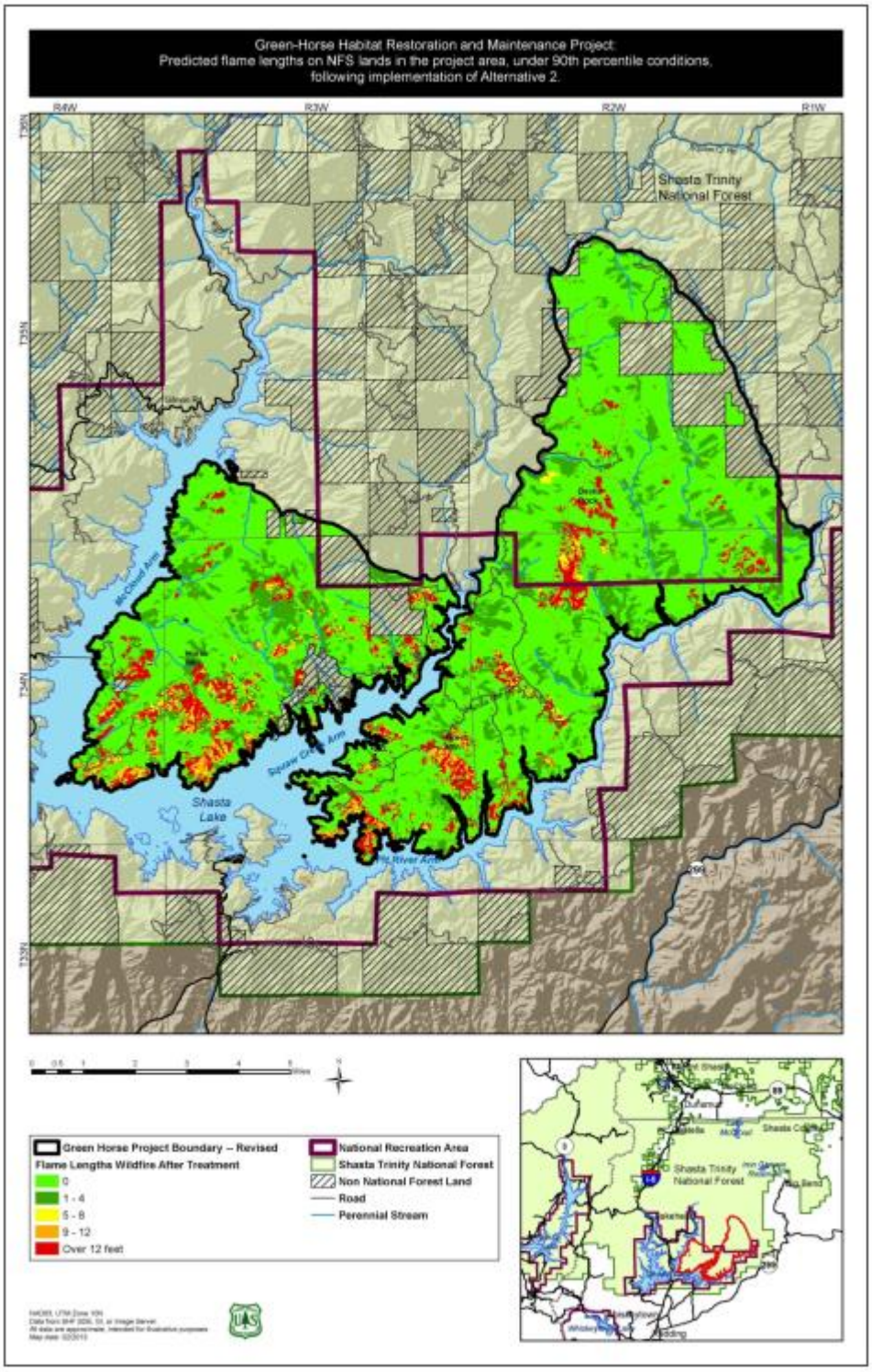

Figure C-8. Predicted flame lengths during a future wildfire after implementation of Alternative 2

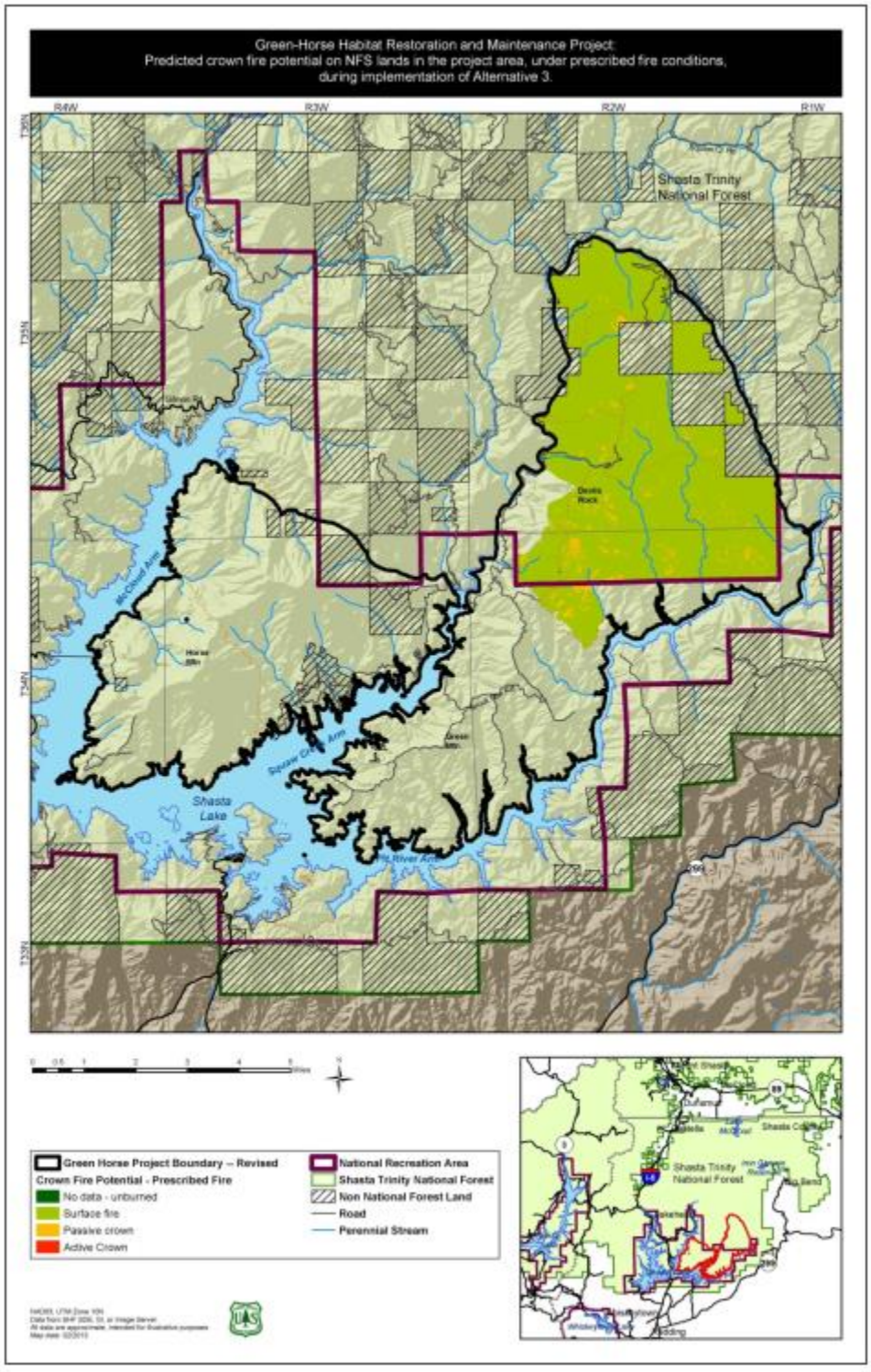

Figure C-9. Predicted crown fire potential during prescribed fire treatments – Alternative 3

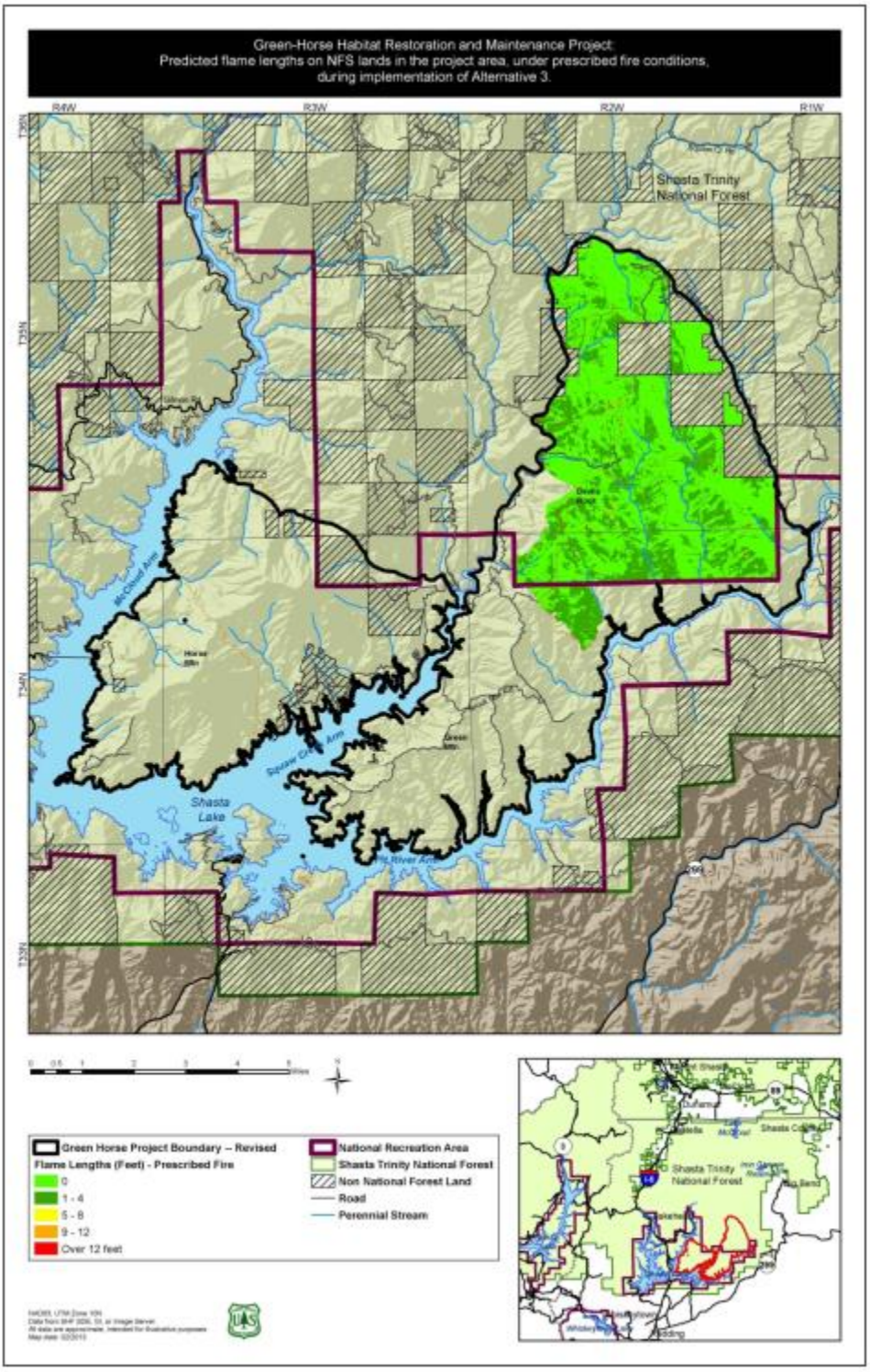

Figure C-10. Predicted flame lengths during prescribed fire treatments – Alternative 3

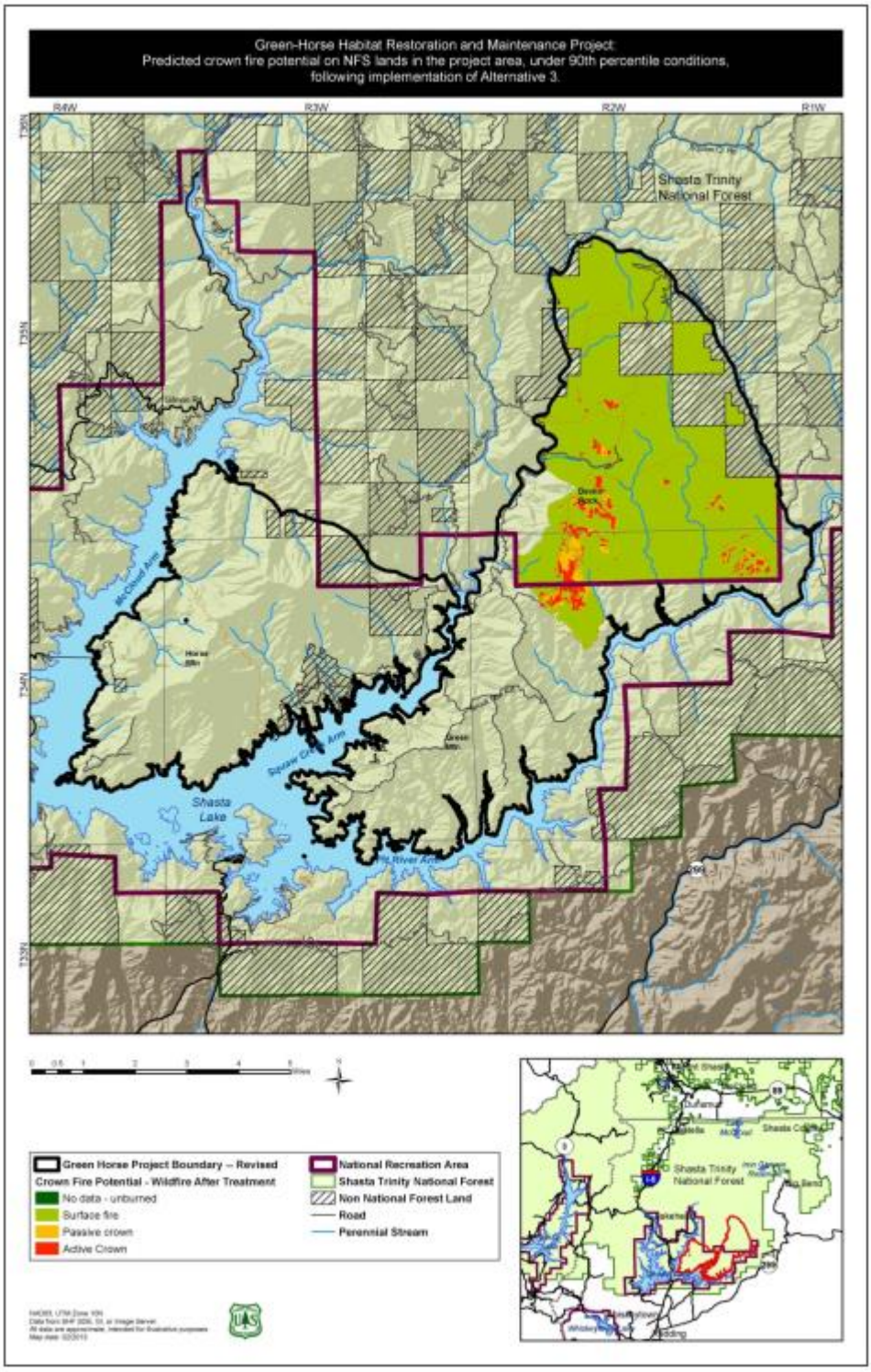

Figure C-11. Predicted crown fire potential during a future wildfire after implementation of Alternative 3

Refer to figure C-3 above for predicted crown fire potential during a future wildfire in the areas not treated.

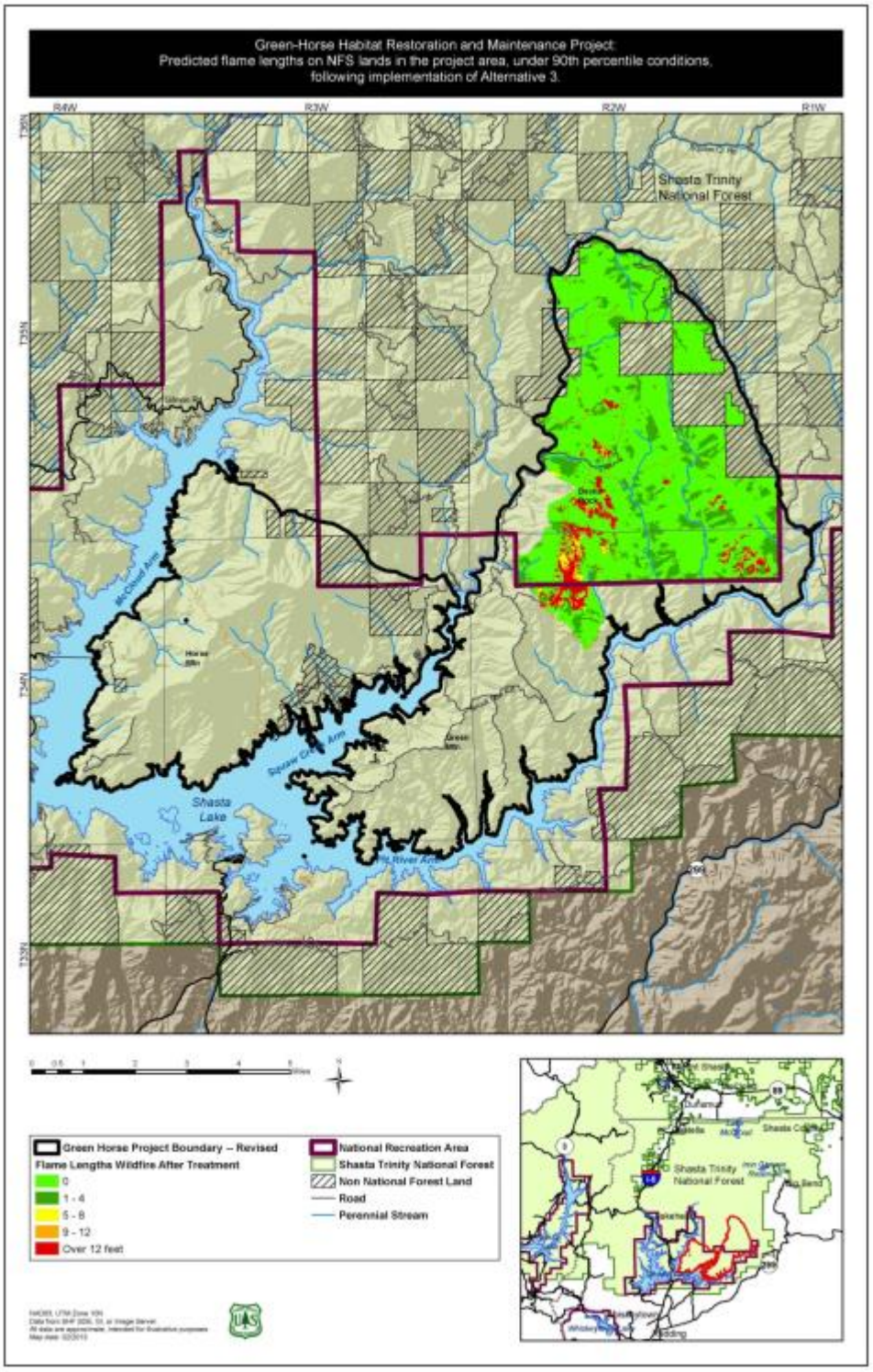

Figure C-12. Predicted flame lengths during a future wildfire after implementation of Alternative 3

Refer to figure C-4 above for predicted flame lengths during a future wildfire in the areas not treated.

Appendix D – Public Involvement – Public Participation Plan and Scoping

Public Participation Plan

A public participation plan was prepared in order to solicit timely and useful input from members of the public and other agencies on the Green-Horse Habitat Restoration and Maintenance Project. Table D-1 below details the process by which the public was informed of the proposed action and encouraged to comment on the project.

Table D-1. Public Participation Plan – Green-Horse Habitat Restoration and Maintenance Project.

Public Participation Activity	Responsibility	Planned Date	Accomplished Date
Post proposal to PALS (Planning Appeals and Litigation System) database and Forest website.	District Liaison	6/29/2009	6/29/2009
List Proposal in Schedule of Proposed Actions	District Liaison	7/01/2009	7/01/2009
Consultation initiated with local Tribes	District Ranger, Forest Archaeologist	12/2/2010, 4/12/2010, 11/7/2012, 2/5/2013,, 09/12/2014	
Publish Notice of Intent in Federal Register	Project Leader	5/27/2011	5/27/2011
Send scoping letter to mailing list – purpose and need, proposal and maps to interested parties, adjacent landowners, Tribes, Board of Supervisors, CDFG, USFWS, NMFS, and CVRWQCB.	Project Leader	5/27/2011	5/27/2011
Post scoping letter to Forest website.	Project Leader and Public Affairs Assistant	6/03/11	6/03/11
News release published in Redding Record Searchlight	Project Leader	6/25/2011	6/25/2011
Legal notice of availability and 30-day comment published in Federal Register	Project Leader	7/2013	
Consultation with USFWS/Level One Meeting	Forest Biologists	If needed	
Draft EIS posted to Forest website	Project Leader	7/2013	
Copies of Draft EIS mailed to those who requested them.	Project Leader	7/2013	
News release published in Redding Record Searchlight	Project Leader	7/2013	
Final EIS / Draft Record of Decision	Project Leader, Forest Supervisor	1/2014	
Legal notice of availability and 45-day objection period published in Federal Register	Project Leader, Forest Supervisor	1/2014	
News release published in Redding Record Searchlight	Project Leader	1/2014	
Final Record of Decision	Project Leader, Forest	4/2014	

Public Participation Activity	Responsibility	Planned Date	Accomplished Date
	Supervisor		
Notice of Intent submitted to CVRWQCB	Project Leader, Forest Hydrologist	4/2014	

Content Analysis of Scoping Comments, Issue Disposition and Issue Indicators

Comments Received

The Forest Service received a total of eight comment letters and emails during the scoping period. The comments were sent by private individuals, the Conservation Congress, the Environmental Protection Information Center and Klamath Siskiyou Wildlands Center and the Shasta County Air Quality Management District. See table D-3 at the end of this document for a list of commenters.

Six of the comments expressed support for the overall objectives of the project. Some comments raised project-specific concerns about air quality, soils, wildlife, heritage resources, special areas that might be affected, and the proposed project-level Forest Plan amendment. Other comments posed questions about or offered recommendations for implementation of the proposed action. Several comments related to the NEPA process itself and to procedural concerns for effects analysis.

Comment letters are filed in the project record.

Issue Disposition Process

Issues are points of discussion, dispute, or debate about the effects of the proposed action. Alternative-driving issues are those that cannot be resolved through project design features but must be addressed through development of an alternative to the proposed action. The following process was used to sort through public input to determine which concerns rise to the level of issues, and to identify which issues drive development of additional action alternatives and which are analysis issues to be addressed in the EA.

Identify Concerns

Analysis of scoping comments identified concerns that were processed to determine if they are potential NEPA issues. Comment letters and other forms of input were tracked during processing, and to provide documentation for the project record.

Categorize Concerns

Comments and concerns were assigned to one of the following categories. Similar issues were grouped. This process is documented in table D-2 below.

1. **Alternative-Driving Issue**. Alternative-driving issues generally concern resources that may be impacted by implementation of the proposed action and cannot be resolved through project design. An alternative-driving issue is addressed by development and analysis of an alternative to the proposed action.
2. **Other Issue**. Other issues are designated as such for any of the following reasons:
    1. The issue is already decided by law, regulation, Forest Plan or other higher level decision.

2. The issue is outside the scope of the proposed action. The issue is not part of the proposal or is not affected by it.
3. The issue is irrelevant to the decision to be made.
4. The issue is conjectural and not supported by scientific or factual evidence.
5. The issue is an analysis issue relevant to the proposed action but has limited duration or intensity of impacts or for which impacts have been resolved through project design features. Analysis issues are carried through effects analysis by project specialists – the analysis is documented in specialist reports to the project file and disclosed in the Environmental Assessment.

3. **Procedural Concern**. These are concerns that may be addressed through implementation of standard design features, or completion of processes routinely conducted by the interdisciplinary team. For example, concerns associated with aquatic resources may be addressed through application of Best Management Practices. It is common to receive scoping comments reminding us to consider or conduct certain processes, such as consultation with the State Historic Preservation Office (SHPO) or the US Fish and Wildlife Service (FWS), or cumulative effects analyses.
4. **Alternative**. The public may suggest an alternative, which is addressed in the environmental document. The alternative may be analyzed fully or, if it does not meet the purpose and need, rationale presented for why it was dropped from full consideration.
5. **Other Concern.** The concern is a question or expresses a misunderstanding about the project.
6. **Statement of Support.** The comment is a general statement of support for the proposed action.

Assign Indicators

Assign indicators to analysis issues; the indicators should be measurable, predictable, and responsive to the issue. Issues and indicators are submitted to the Deciding Officer for approval. Based on the analysis of comments, the proposed action was revised to include an additional 20 acres of treatment around recreational residences on NFS lands north of Campbell Creek. One additional action alternative was suggested with regard to the proposed Forest Plan amendment; this alternative was analyzed in detail. One other suggested alternative related to biomassing was not considered in detail, with rationale presented in Chapter 2. Analysis issues identified during the scoping period related to air quality, fire risk, soils and water quality, recreation, botany and fish and wildlife species and habitat.

Issue Disposition of Scoping Comments

Table C-2 on the following pages displays the disposition of public comments received during the scoping period for the Green-Horse Habitat Restoration and Maintenance Project.

Table D-2. Content analysis and issue disposition, Schweitzer Fuels Reduction Project. See table D-3 below for commenter identification.

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
ADAPTIVE MANAGEMENT STRATEGY	05	…concerned about the 7-10 year timeframe since NEPA states environmental documents are stale after 5 years. A lot can change in 10 years. We are also concerned about the potential for abuse using the Adaptive Management Strategy. While we see the value of correcting mistakes or realizing second treatments are not necessary we would recommend when these types of decisions are made that the public is fully informed. It would not be too burdensome for the Forest to send out its annual monitoring report on this project to those who have expressed interest stating what has worked and what hasn't. That way there would be a transparent process with full disclosure.	**Procedural concern** • NEPA documents do not have a defined "expiration date" and nowhere do NEPA regulations state that "environmental documents are stale after 5 years". • Any changes to the proposed action deemed necessary by changed conditions or unforeseen events would be documented to the project file • The Adaptive Management Strategy is not intended merely to "correct mistakes", but is intended to allow the agency to respond to changed conditions such as wildfire, etc. • Forest Plan monitoring report is posted on the Web, but may not include specific projects.	**N/A**
AIR QUALITY	…05	With a project of this magnitude we have general concerns for…air quality…	**Analysis issue** • Design features for air quality • Air quality effects analysis • The No Action alternative addresses this issue (including the potential effects of No Action on air quality in the event of a wildfire).	**Effect of project activities on air quality** • Predicted smoke emissions from each alternative based on fuel loadings • Consistency of predicted smoke emissions with state and federal standards (The Clean Air Act, state guidelines, etc.) • Compliance with the General Conformity Rule for PM 10.

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
AIR QUALITY	08	…the District will be coordinating any large-scale burning activities with great concern for down-wind communities and the Sacramento Valley Air Basins…a Smoke Management Plan will be required to be submitted and approved by the District prior to any burning.	**Procedural concern**	**N/A**
AIR QUALITY	08	As a suggestion, it would be advisable to plan frequent, smaller-scale burns in an effort to reduce smoke impacts and increase the likelihood that a burn can be conducted…the intent to burn 5,000 acres each year, for the next 7 to 10 years,, in an area less than 20 air miles directly north of Redding and other populous areas, is a lofty goal…would more than double the total annual acreage burned under prescription in Shasta County, as a whole.	**Analysis issue** • Although approximately 5,000 acres would be treated each year, each treatment would result in a mosaic of mostly low-to moderate-intensity fire, with a few scattered pockets of high-intensity fire and some areas that would be unburned.	**See above**
AIR QUALITY	08	The District believes that it would be appropriate to include in the EIS, a detailed analysis of biomassing, as a mitigation option in reducing the amount of material burned…It should be explained in the EIS why biomassing is not considered as a form of fuels treatment in a landscape that has been managed, in such a way, that it now has un-natural fuel loading.	**Alternative not considered in detail** • lack of road access to remove enough product to measurably reduce the amount of prescribed fire. • Biomassing on a landscape scale is not economically feasible and may result in substantial ground disturbance, with associated adverse environmental effects.	**N/A**

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
COARSE WOODY DEBRIS	07	We are extremely concerned about … CWD retention. The DEIS should disclose the current condition as site specifically as possible concerning…CWD so that the public is made aware of actual on-site effects of activities.	**Analysis issue / procedural concern** • Project design features for coarse woody debris retention • Project design features for Fire and Fuels (timing of ignition based on weather and fuel moisture conditions conducive to achieving the desired objectives). • The No Action alternative also addresses this issue	**Effects of the proposed action on coarse woody debris** • Predicted changes in coarse woody debris from current levels
CUMULATIVE EFFECTS	05	…we are concerned about the magnitude of this project when combined with the I-5 Corridor Fuels Project and the Bear Hazardous Fuels Project. These three projects combined will result in the entire Shasta Lake Unit being burned. We believe it would be more appropriate to conduct a Programmatic EIS that addresses all three projects thereby meeting the NEPA requirements to take the requisite 'hard look' at connected actions…We would suggest implementing the Bear Hazardous Fuels Project and see how it turns out before attempting to implement this much larger project. The Forest will learn what worked and perhaps what didn't work thereby learning what to apply to this project…	**Procedural concern** • Preparing a Programmatic EIS for the three projects mentioned is not a requisite for meeting NEPA requirements to take a "hard look" at connected actions. • The proposed adaptive management strategy would provide for adjustments in implementation based on outcomes of the Bear project.	**N/A**
DOZER LINES	05	We would object to any dozer lines in the IRA, RNA or LSR.	**Other issue – beyond the scope** • No dozer lines are proposed in the RNA, IRA or any LSR	**N/A**

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
DOZER LINES	07	We are strongly opposed to the use of Dozer lines. Dozer lines are not only an eyesore, they disrupt and compact soils, contribute to habitat fragmentation and most importantly they may be highly ineffective.	**Analysis issue** • Dozer lines along ridges are proposed to facilitate implementation of prescribed fire. The scoping document stated that the lines would be approximately 8 feet wide. • The area affected would be small (5 dozer lines totaling approx. 4.61 miles or 4 acres) • Project design features to protect soils • Project design features include the concealment of all fire lines to avoid notice by the casual forest user. • The commenter provided no rationale for why the proposed dozer lines "may be highly ineffective" in managing prescribed fire.	**Effects of the proposed action on visual quality, soils and habitat fragmentation** • Discuss in scenery, soils and wildlife reports
DOZER LINES	07	The Shasta-Trinity National Forest should first address the hundreds (over 500 miles) of mile of dozer lines that were punched in during recent fire events and have not been maintained.	**Other issue – beyond the scope** • There are no existing suppression dozer lines within the project area. All dozer lines in the project area were established for the Green Mountain Prescribed Fire project. • Dozer lines outside the project area are beyond the scope of this project.	**N/A**
FIRE / FUELS	05, 07	The STNF does not have a successful track record for prescribed burning; in fact the record is bleak with out of control fires. We are very concerned about the risks of prescribed burning and the chance that underburning may reach the canopy and induce unintended high severity fire. While some risk is inevitably involved, there should be a plan in the DEIS as to how the Shasta-Trinity National Forest plans on dealing with that possibility. Please include the Fire Plan as an appendix to the DEIS or provide EPIC with a hard copy.	**Procedural concern** • Project design features for Fire and Fuels, including implementation during weather, fuel moisture conditions conducive to achieving the desired objectives – a mosaic of low- to moderate-intensity ground fire with scattered small areas of high-intensity crown fire. • Contingencies for escaped fire would be part of a prescribed fire plan prepared before implementation and reviewed annually. • A prescribed fire plan is a site-specific implementation document that provides information needed to conduct prescribed fire. The plan is not intended to be a part of the NEPA process.	**N/A**

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
FIRE/FUELS	02, 03, 04, 06	I am asking you to move the north boundary of the Green-Horse project from the south side of Campbell Creek far enough to the north to provide meaningful protection to the cabins on the north side of Campbell Creek. We would ask that: under the fuels management investments, the current project boundary be modified to include the Campbell Creek Tract in its entirety. Re-aligning the Green-Horse Project Boundary, specifically the project fuels reduction, to the north side of Campbell Creek will provide protection for all SUP owners in the cove. …an alternate plan which incorporates and [sic] expansion of the northern boundary of the…project…would accomplish several worthy goals…prudent from a risk management perspective by eliminating the danger associated with a fire approaching the FS Recreation Tract from the north…economy of scales associated with completing both the north and south side of Campbell Creek concurrently…	**Proposed Action - revised** • Project area boundary will be expanded to include the peninsula adjacent to recreation residences on the north side of Campbell Creek. • The revised proposed action will add fuels treatments adjacent to the recreation residences at Campbell Creek. • The treatments would consist of hand thinning, pruning and piling and burning of hand piles – similar to the bald eagle nest site treatments under the proposed action. • Approximately 20 additional acres of treatment would occur under the revised proposed action.	**N/A**

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
FOREST PLAN AMENDMENT	07	The scoping notice contains conflicting guidelines. As a wildlife Project Design Feature (PDF) it states, "do not go below Forest Plan standards for snags and logs per acre." It also is proposing a plan amendment to change the requirement of 20 tons per acre of downed wood to 5 to 15 tons per acre, within the Limited Roaded Motorized and Roaded Recreation management areas.	**Other issue** • The contention that the scoping notice contains conflicting guidelines is incorrect. • The scoping document clearly states that the Forest Plan amendment for downed wood in the two relevant management prescriptions is for an ***average*** of 5-15 tons per acre. The scoping document states that "***The desired fuel loading may vary across the project area*** *according to factors such as current fuel levels, vegetation type, wildlife habitat needs (e.g., protection of bald eagle nest sites and provisions for fisher, marten and northern spotted owls), soil standards, and/or wildland-urban interface prescriptions*." • The Forest Plan amendment addresses dead and down material, which includes snags, coarse woody debris, smaller diameter material and fine organic matter. The project does not propose to reduce the overall number of snags across the project area – some may be consumed in the limited areas that burn with crown fire, but snag recruitment in these areas is expected to offset the scattered loss of existing snags. In most NFS lands within the two management prescriptions for which the FP amendment is proposed the fuels components of concern are the smaller diameter materials and fine organic matter. Many of these areas don't contain a CWD component (e.g., brushfields and hardwood stands). • Alternative 3 also addresses this issue	**N/A**
FOREST PLAN AMENDMENT	07	The DEIS must be site specific as to what is being proposed…the difference between 5 to 15 tons per acre is significant.	**Procedural concern**	**N/A**

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
FOREST PLAN AMENDMENT	07	…we do not believe that the fear of wildfire is worth the risk of losing this important forest structure in LSR, RR, IRA and RNAs. Please follow LRMP direction for snag and LWD [large woody debris – also known as coarse woody debris or CWD] guidelines.	**New action alternative (Alternative 3)** • No Forest Plan amendment • Only 4,712 acres within Management Prescriptions II and III currently meet Forest Plan standards for dead/down material; of that, only six acres would meet FP standards after fuels treatment, so these areas were dropped for this alternative. • Alternative 3 addresses this issue • Note: the comment refers to Forest Plan "snag and LWD" guidelines. The proposed Forest Plan amendment also includes fine organic matter and smaller diameter material. The project does not propose to reduce the overall number of snags across the project area – some may be consumed in the limited areas that burn with crown fire, and snag recruitment in these areas is expected to offset the scattered loss of existing snags. In most NFS lands within the two management prescriptions for which the FP amendment is proposed the fuels components of concern are the smaller diameter materials and fine organic matter. Many of these areas don't contain a CWD component (e.g., brushfields and hardwood stands).	**Effects of the proposed Forest Plan amendment on coarse woody debris (CWD)** • Predicted change in coarse woody debris from current levels
FOREST PLAN AMENDMENT - IRA	05	Is [Devil's Rock IRA] included in the Limited Roaded Motorized management prescription? If so, we would object to the proposed LRMP Amendment for that prescription. IRA's should remain in as natural a state as possible since they also provide habitat for TES species and are potential wilderness areas.	**Analysis issue** • Approximately 3,128 acres of the IRA are within the Limited Roaded Motorized Recreation prescription. • The proposed Forest Plan amendment provides for a range of dead and down material based on fuel reduction objectives and other resource concerns (e.g., soils, wildlife, etc.). This range is considered to be what naturally occurred before the advent of fire suppression • Current vs. historical conditions re: the effects of over 100 years of fire suppression – current fuel concentrations are not considered "natural". • Alternative 3 also addresses this issue	**Effects of the proposed action on IRA values** • Address in request for approval from RO for fuels treatment in IRA and in the EA
FOREST PLAN AMENDMENT - RNA	05	Is [the RNA] included in the Limited Roaded Motorized management prescription? If so, we would object to the proposed LRMP Amendment for that prescription. RNAs are to remain in a natural state for research purposes and to provide a valid baseline for natural processes.	**Other issue** • The RNA is in Management Prescription 10 (Special Area Management) and does not overlap with management prescription 2 (Limited Roaded Motorized Recreation).	**N/A**

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
FUEL BREAKS	07	Fuels reduction within fuelbreaks/flanks benefits only those sites, while existing hazardous fuel loads outside of fuelbreaks/flanks remain untreated and susceptible to severe fire effects during extreme weather conditions. The analysis for the Herger-Feinstein Quincy Library Group Forest Recovery Act disclosed current research findings from Dr. Mark Finney that disputes the efficacy of linear fuelbreaks, and instead, favors area-wide treatments primarily with prescribed underburning. Fuelbreaks are clearly and specifically designed for fire suppression actions--this is where firefighting is intended to occur. Accordingly, the environmental impacts of firefighting in fuelbreaks must be specifically analyzed and explicitly disclosed.	**Other issue - beyond the scope** • No fuel break construction is proposed. • The dozer lines are proposed to facilitate implementation of the proposed prescribed fire activities. The scoping notice made no claim that they are intended as a fuel treatment by themselves. • Dozer lines would be constructed / reconstructed to allow the Forest Service to manage prescribed fire at a time when pre-determined environment variables for ignition are met. The scoping document did not claim that the dozer lines, by themselves, would offer a greatly increased likelihood of success during fire suppression under conditions that are more conducive to dynamic fire behavior.	**N/A**
HARDWOODS	07	How will hardwoods be treated? Hardwoods that are cut and/or masticated will in turn grow into brush. The DEIS must discuss the effectiveness of these treatments into the future and should propose future maintenance.	**Procedural concern** • Project design features and effects analysis for Vegetation structure and composition. • Cumulative effects analysis for Fire and Fuels will address future treatment needs to maintain desired levels.	**N/A**

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
HERITAGE RESOURCES	05	We are concerned about the mitigation for Heritage Resources that states "In areas where vegetation is deemed too think [sic] to perform cultural resource surveys prior to the onset of project activities, adequate surveys would be performed *after* fuels reduction project activities." This plan could result in harm or destruction of heritage resources.	**Analysis issue** • Rationale for analysis methodology for heritage resources • Project design features and effects analysis for heritage resources • The Forest would track implementation and get archaeologists out to the project area in a timely manner. Apply probability model to occurrence of heritage resources. Not all impenetrable brush needs to be surveyed. This is a Forest-wide rather than project-specific data set.	**Effects of proposed action on heritage resources** • Effectiveness of protection measures • Compliance with Region 5 Section 106 Programmatic Agreement
IMPLEMENTATION	01	…in order to adequately address possible impacts of the USFS planned fuels management program on our remediation efforts at the mine, we will need more detailed maps of planned treatments and units near the Trust holdings. What specific treatments are planned directly adjacent to the Trust property and the likely schedule for the treatment?	**Procedural concern** • Project description of private property boundary treatments was included in the scoping document • Implementation would begin in the fall of 2012; the schedule of which areas would be burned at any given time would be determined based on current conditions at the time of implementation.	**N/A**
INVASIVE PLANTS	07	We ask the FS to look into the effects of fire on the invasive plant species within the project area. Some of these plant species may diminish if burned at the right time, such as star thistle. The DEIS should include …a list of what species are occurring and locations.	**Analysis issue** • Project design features to reduce the risk of weed spread • Effects analysis for noxious weeds • The No Action alternative also addresses this issue	**Effects of the proposed action on noxious weed introduction and spread** • Predicted amount (acres) of vegetation severity in known noxious weeds occurrences or suitable habitat • Predicted amount (acres) of ground disturbance in known noxious weeds occurrences or suitable habitat
INVASIVE PLANTS	07	The DEIS should include maintenance and/or plan of reducing these species within the project area,	**Other concern – beyond the scope** • Reducing noxious weeds within the project area – other than as related to the proposed action – is beyond the scope of the DEIS	**N/A**

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
LATE SUCCESSIONAL RESERVES	05	The scoping notice states that without the influence of fire many stands are unlikely to develop into late-successional habitat. The statement is not specific to the LSR and we request clarification. Is this statement specific to the LSR and/or other management areas?	**Procedural concern** • The statement was based on current vs. historic conditions of the habitat and vegetation types over the project area, both within and outside the LSRs • Please note that the only named LSR is the Madrone Late Successional Management Area; all other LSRs in the project area are related to peregrine falcon and/or bald eagle nest sites and may not exhibit any late successional habitat characteristics (the scoping document was in error).	**N/A**
LATE SUCCESSIONAL RESERVES	07	The proposed action should follow all standards and guidelines, related to LSRs, in the NWFP ROD and the LRMP.	**Procedural concern** • Project design features for wildlife • Effects analysis for wildlife, including compliance with the NWFP ROD and the Forest Plan (LRMP)	**N/A**
MADRONE MANAGED LATE SUCCESSIONAL AREA (MLSA)	07	The project area is sensitive because of the special resources values and land allocations including…Brock Mountain (Madrone) Late Successional Reserve [sic]. The DEIS should be as specific as possible when describing the contributions of [this] land allocation…and the effects that the proposed project will have. Treatments must not diminish the characteristics and values that [this] land allocation contains.	**Procedural concern / Analysis issue** • Design features and effects analysis for wildlife, fire and fuels and vegetation • The No Action alternative also addresses this issue	**Effects of the proposed action on the character and values of the Madrone MLSA** • Addressed in wildlife report
PLANT SPECIES OF CONCERN	05, 07	With a project of this magnitude we have general concerns for…sensitive plant species… Please be site specific when describing locations, survey results and PDF for rare, sensitive and Threatened and Endangered plant species. Please also disclose and analyze effects that fire and fuels treatments would have on sensitive and Survey and Manage fungi.	**Procedural concern / analysis issue** • Project design features for plant species of concern • Effects analysis for plant species of concern • The No Action alternative also addresses this issue	**Effects of the proposed action on plant species of concern** • Season of prescribed fire ignition • Predicted amount (acres) of vegetation severity in known rare plant populations or suitable habitat • Predicted amount (acres) of ground disturbance in known rare plant populations or suitable habitat

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
PROPOSED ACTION	07	The scoping notices [sic] fails to provide the public with how many acres and what treatments are proposed in each land allocation.	**Procedural concern** • The scoping document disclosed the acres and types of proposed treatments within project area management prescriptions. The proposed treatments and acres by Forest Plan land allocation are disclosed in the DEIS.	**N/A**
PROPOSED ACTION	07	The Scoping notice did not specifically state whether mechanical mastication is proposed…	**Other concern – beyond the scope** • Mastication is not proposed.	**N/A**
RECREATION - NATIONAL RECREATION AREA	07	The project area is sensitive because of the special resources values and land allocations including the Whiskeytown-Shasta-Trinity National Recreation Area (Shasta Unit)…The DEIS should be as specific as possible when describing the contributions of [this] land allocation…and the effects that the proposed project will have. Treatments must not diminish the characteristics and values that [this] land allocation contains.	**Procedural concern / Analysis issue** • Project design features and effects analysis for recreation	**Effects of the proposed action on characteristics and values in the Whiskeytown-Shasta-Trinity National Recreation Area** • Duration and extent of trail and other project area closures • Duration and intensity of noise disturbance • Duration and intensity of smoke disturbance • Betsy will work with Ben on this
RESEARCH NATURAL AREA	07	The project area is sensitive because of the special resources values and land allocations including…Devils Rock-Hosselkus Research Natural [Area]… The DEIS should be as specific as possible when describing the contributions of [this] land allocation…and the effects that the proposed project will have. Treatments must not diminish the characteristics and values that [this] land allocation contains.	**Procedural concern / Analysis issue** • The Forest is preparing a management plan for the RNA • Project design features specific to the RNA, if needed • The No Action alternative also addresses this issue	**Effects of the proposed action on RNA characteristics and values** • Betsy will work with Ben on this

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
ROADLESS AREA	07	The project area is sensitive because of the special resources values and land allocations including…Devils Rock Inventoried Roadless Areas…The DEIS should be as specific as possible when describing the contributions of [this] land allocation…and the effects that the proposed project will have. Treatments must not diminish the characteristics and values that [this] land allocation contains.	**Procedural concern / Analysis issue** • Fuel levels are not considered to be at "naturally occurring" levels • A roadless area analysis will be conducted	**See above under Forest Plan Amendment - IRA**
SOILS	05	With a project of this magnitude we have general concerns for…soils…	**Analysis issue / Procedural concern** • Project design features and effects analysis for soils	**Effects of the proposed action on soil productivity and soil integrity** • Predicted changes in surface erosion • Predicted changes to groundcover and duff consumption • Predicted impacts based on predicted fire severity

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
SOILS	07	The National Forest Management Act regulations require the "conservation of soil..." 36 CFR §219.27. Section 219.27(a)(1) provides that "[a]ll management prescriptions shall-[c]onserve soil…resources and not allow significant or permanent impairment of the productivity of the land." Section 219.27(b)(5) provides that "[m]anagement prescriptions that involve vegetative manipulation of tree cover for any purpose shall-[a]void permanent impairment of site productivity and ensure conservation of soil…resources." Further, [c]onservation of soil…resources involves the analysis, protection, enhancement, treatment, and evaluation of soil…resources and their responses under management and shall be guided by instructions in official technical handbooks." 36 C.F.R. §219.27(f).	**Analysis issue / Procedural concern** • The commenter merely quoted NFMA regulations • Project design features and effects analysis for soils, including a determination of compliance with regulatory direction for each alternative	**See above**
STATEMENT OF SUPPORT	05	We are pleased to see the STNF reintroducing fire into the ecosystem …We greatly appreciate that this project does not include any commercial timber harvest, new forest system or temporary road construction, or existing road reconstruction.	**Statement of support**	**N/A**

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
STATEMENT OF SUPPORT	07	We appreciate that there is no commercial component or road building in this proposed project and applaud the agency for introducing fire onto the landscape.	**Statement of Support**	**N/A**
STATEMENT OF SUPPORT	02, 03, 04, 06	In general the project is excellent and much needed. It appears the project has the potential to provide excellent fire protection to the FS Recreation Tract cabins on the south side of Campbell Creek. Some protection will be provided to the cabins on the north side of the creek if a fire were to come from the south. In general this project is excellent and we support this much needed cleanup. It appears the project has the potential to provide the much needed fire protection to many of the SUP owners in the Shasta-Trinity Recreation Area and National Forest. On the whole, I believe the project is beneficial in nature…	**Statement of Support**	**N/A**
WATER QUALITY	05	With a project of this magnitude we have general concerns for…water quality	**Analysis issue / Procedural concern** • Project design features for water quality • Effects analysis for water quality • The No Action alternative also addresses this issue.	**Effects of the proposed action on water quality** • Predicted changes in stream temperature, pH and nutrients • Predicted changes in hydrologic regime and debris flows

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
WATER QUALITY	07	We cannot overstate our extreme concern for Riparian Reserves. The PDFs in the scoping notice constantly allow activity and equipment into Riparian Reserves. The project should follow ACS guidelines and not allow ground-based equipment into Riparian Reserve widths as spelled out in the NWFP ROD and LRMP in order to comply with ACS objectives.	**Other issue – beyond the scope** • The commenter is mistaken - nowhere do the project design features "constantly allow activity and equipment into" riparian reserves. No ground-based equipment is proposed in riparian reserves. • The project does follow ACS guidelines	**N/A**
WATER QUALITY	07	Any activity proposed in RRs should be analyzed and disclosed on a site-specific basis and forego being extremely broad and general. Mapping should also reflect RRs and project activities in the DEIS.	**Analysis issue / Procedural concern** • Project design features for riparian reserves • Effects analysis for wildlife, hydrology, fisheries and soils • The No Action alternative also addresses this issue.	**Effects of the proposed action on the function and integrity of riparian reserves** • See issue indicators for water quality above
WILDLIFE	05	We are very concerned about the portion of the project in LSR. Until the forest meets its ESA obligations we recommend dropping this portion of the project, otherwise it will be illegal.	**Alternative – no treatments in LSRs / Analysis issue** • The commenter did not indicate how fuel treatments in LSRs would be illegal or what ESA obligations the forest has not met. • LSRs in the project area are designated for bald eagle and peregrine falcon nest sites and not for late-successional habitat characteristics. There is only one named LSR in the project area (Madrone MLSA – DD-83) in the project area.	**Effects of the proposed action on the function of LSRs proposed for treatment** • Addressed in wildlife report
WILDLIFE	05	The Forest must also address the presence of Barred owls on the Forest and the impact they are having on Northern spotted owls. LOPs are not sufficient mitigation in light of these invasive Barred owls. The Forest must also consider …how many…Barreds are using the LSR…	**Other issue - beyond the scope** • The commenter failed to indicate how the proposed action would favor barred owls over northern spotted owls	**N/A**
WILDLIFE	07	Will enough cover be left to protect deer and bear from harassment and poaching?	**Procedural concern / Analysis issue** • Deer and bear are not addressed in MIS but will be addressed in wildlife analysis	**Effects of the proposed action on deer and bear** • Addressed in wildlife report

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
WILDLIFE	05, 07	We encourage the STNF to initiate formal consultation with the USFWS for this project to determine the amount of burning that could occur in a single year. The DEIS should include consultation with the Fish and Wildlife Service.	**Procedural concern** • Consultation with US Fish and Wildlife Service will occur as needed and as required by law. • Formal consultation is initiated when there is a preliminary determination of "likely to adversely affect". The preliminary determination for this project is "not likely to adversely affect", so informal consultation will be conducted.	**N/A**
WILDLIFE – BALD EAGLE	05, 07	With a project of this magnitude we have general concerns for wildlife, particularly…Bald eagles… Project Design Features should give maximum protection for eagles especially from noise, whether nesting or not. The DEIS should be very descriptive when describing activities on these acres and we recommend a "light" touch. Please analyze and disclose the effects of fuels treatments on prey species.	**Analysis issue / Procedural concern** • Project design features for bald eagles (e.g., LOPs, hand piling, etc.) • Effects analysis for bald eagles • Protection measures are already above and beyond what is required in bald eagle guidelines • The No Action alternative also addresses this issue	**Effects of the proposed action on bald eagle nesting habitat** • Addressed in wildlife report
WILDLIFE – HABITAT	07	A multitude of species relies on dense cover and brush for survival. The DEIS must detail the effects of removing such a great amount of cover for these species, especially within Riparian Reserves.	**Analysis issue** • The commenter did not indicate what constitutes the "great amount of cover" that would be removed. • Other than the specified 34 acres of bald eagle treatments and 37 acres of private property boundary treatments within riparian reserves, the project proposes to allow prescribed underburns to back down into riparian reserves to achieve fuel reduction objectives. • At no point will all of the cover for wildlife in the project area be affected by one, or even several, treatments. A planned mosaic of burned and unburned vegetation will allow for cover to be maintained within close proximity to openings, which will offer both foraging and hiding opportunities for wildlife. Within Riparian Reserves, generally only undergrowth will be affected by backing fire down slope into these areas; with the possibility of only small openings in the canopy that would allow sunlight to reach the understory and encourage the development of new herbaceous growth.	**Effects of the proposed action on wildlife species of concern with the potential to occur in the project area and their associated habitat.** • Predicted changes in habitat for TES species as measured by changes to vegetation composition and forest structure. • Predicted changes in to the amount, proportion, and distribution of Management Indicator Assemblage habitats, as measured by predicted changes to vegetation composition and forest structure.

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
WILDLIFE - MIS	07	The Shasta-Trinity National Forest should perform surveys for Management Indicator species and disclose and analyze effects of fuels treatments and burning on these species.	**Procedural concern / Analysis issue** • Effects analysis for wildlife management indicator species • Surveys are not required and they would not be meaningful, since the Shasta-Trinity NF uses habitat assemblages instead of species	**See above**
WILDLIFE – NEOTROPICAL MIGRATORY BIRDS	07	The Migratory Land Bird Conservation Report does not discuss the effects of mastication or Riparian Reserve thinning/underburning or how changes to early seral and shrub habitat would affect neo-tropical migratory bird species. The DEIS should disclose and analyze science based reasoning and effects of burning and fuels treatments on neo-tropical migratory bird species.	**Procedural concern** • Mastication is not proposed for this project • Non-commercial thinning (hand thinning) in riparian reserves would occur on approximately 34 acres within bald eagle and peregrine falcon nest site treatments and 37 acres within private property boundary treatments.	**N/A**
WILDLIFE – NORTHERN SPOTTED OWL	05	The Forest must also consider the role fire plays in LSR; the fact owls use burned habitat; how the LSR is currently functioning; how many NSO…are using the LSR; and identify whether any Critical Habitat Units are in the project area since new critical habitat has been designated in the current recovery plan.	**Procedural concern** • Project design features (e.g., LOPs) • Effects analysis for wildlife • According to the project wildlife biologist, there is little northern spotted owl (NSO) habitat in the project area and no known NSO activity centers (the Forest LSR assessment references a historical site).	**N/A**

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
WILDLIFE – NORTHERN SPOTTED OWL	05	We also strongly object to the provision that states no more than 50 percent of the nesting, roosting, or foraging habitat (NSO) would be burned or mechanically treated in a single year in any one 7th field watershed up to 3,500 acres in size. This is far too aggressive considering the current status of the owl in general and the largely unknown status of the owl on the STNF.	**Analysis issue** • The commenter did not indicate why the amount of prescribed fire proposed for treatment each year was too aggressive, or what amount of prescribed fire would be acceptable. • According to the project wildlife biologist, there is little NSO habitat in the project area and no known NOS activity centers. • Project design features and effects analysis for NSO	**See above**
WILDLIFE – NORTHERN SPOTTED OWL	07	"Madrone MLSA provides suitable spotted owl habitat. All of Madrone has been surveyed for spotted owls; a total of one activity center is known to occur." LSRA 2-70. Please include survey results and general location of Activity Centers in the DEIS and include Nesting/Roosting habitat on maps with land allocations so that the public and decision maker have a clear idea of what is happening in theses [sic] areas.	**Procedural concern** • According to the project wildlife biologist, there is little northern spotted owl (NSO) habitat in the project area and no known NSO activity centers. • Effects analysis for NSO	**N/A**
WILDLIFE – PACIFIC FISHER	07	The forthcoming NEPA document must address the impacts of fuel treatments, the proposed Plan Amendment and dozer construction on Fishers.	**Procedural concern** • Effects analysis for Pacific fisher	**See above**
WILDLIFE – REPTILES AND AMPHIBIANS	05	With a project of this magnitude we have general concerns for wildlife, particularly…reptiles and amphibians	**Analysis issue** • Project design features for wildlife and wildlife habitat • Effects analysis for wildlife	**See above**

Category	Commenter	Comment	Disposition	Issue / Issue Indicator(s)
WILDLIFE – SENSITIVE SPECIES	07	The Shasta-Trinity National Forest must conduct, disclose and analyze surveys and results to determine how proposed projects are effecting [sic] populations and individual species, as directed in the LRMP.	**Analysis issue / Procedural concern** • Project design features for sensitive wildlife species • Effects analysis for sensitive wildlife species	**See above**
WILDLIFE - SNAGS	07	We are extremely concerned about snag…retention. The DEIS should disclose the current condition as site specifically as possible concerning snags…so that the public is made aware of actual on-site effects of activities Large snags are a key late-successional characteristic. Hence snags should be retained as essential habitat elements in a Late Successional Reserve. A variety of snags should be left in the project area especially snags over 18 inches as they provide shelter for bats, birds and a food source for woodpeckers.	**Analysis issue** • Project design features for snag retention. • Project design features for Fire and Fuels (timing of ignition based on weather and fuel moisture conditions conducive to achieving the desired objectives – a mosaic of low- to moderate-intensity ground fire with scattered, small areas of crown fire). • The proposed action would not remove any snags from the project area. On rare occasions when snags identified as danger trees cannot be avoided, those snags would be felled and left on site, either as coarse woody debris (CWD) or, if in excess of CWD requirements, to be consumed by prescribed fire. Some standing snags may be consumed in the limited areas that experience high intensity crown fire – however, in these areas, recruitment of new snags would also be expected to occur. • The No Action alternative also addresses this issue	**See above**
WILDLIFE - SNAGS	07	All large trees should be retained in late successional reserves and Riparian Reserves regardless because they play important roles while standing, decaying and lying on the forest floor.	**Other issue – beyond the scope** • Removal of large trees in late successional reserves and riparian reserves is not proposed.	**N/A**
WILDLIFE – SURVEY AND MANAGE SPECIES	07	While the scoping notice states that PDF will buffer limestone outcroppings we believe that wildlife biologists must also survey the area and should consider other potential habitat.	**Procedural concern** • Analysis methodology and effects analysis for wildlife • Surveys were conducted as needed by the project wildlife biologist	**N/A**

Table D-3. Commenter Identification, Trinity Alps Wilderness Prescribed Fire Project

Commenter Number	Commenter	Type of Comment
01	Wendy Johnston, Vestra Resources, Inc.	Scoping Comment dated 5/31/11
02	John Hallgren	Scoping Comment dated 6/10/11
03	Dan and Cathy Sampson	Scoping Comment dated 6/10/11
04	Gary Penberthy	Scoping Comment dated 6/10/11
05	Denise Boggs, Conservation Congress	Scoping Comment dated 6/14/11
06	John C. and Linda Clayton	Scoping Comment dated 6/21/11
07	Kimberly Baker – Environmental Protection Information Center (EPIC) and Klamath Siskiyou Wildlands Center	Scoping Comment dated 6/23/11
08	John Waldrop – Shasta County Air Quality Management District	Scoping Comment dated 6/28/11

Appendix E – References

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